1996

Guidelines for New Brunswick Woodlot Owners

Terry O'Donnell
Forest Conservation Section

New Brunswick
Natural Resources and Energy

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Important notice

Please note the following policy clarification with respect to the Department of Environment's requirements for Watercourse Alteration Permits. *Stream width is no longer a factor when determining the need to obtain Watercourse Alteration Permits when working near a watercourse.*

The Department of Environment currently relies on the New Brunswick government's 1:10,000 scale orthophoto maps when determining whether an activity requires a permit or not. In other words, if an alteration occurs along a watercourse at a location where that watercourse is indicated on the orthophoto maps, that activity is deemed to require a Watercourse Alteration Permit. Activities that occur at a location on the orthophoto map where no watercourse is shown do not require a permit.

It is important to note that this policy applies only to the need to apply for a Watercourse Alteration Permit. In no way does it free one from penalties as described under the Clean Water Act for activities that negatively affect water quality or flow, regardless of the stream size or whether the watercourse is, or is not, shown on the orthophoto map.

Confirmation as to whether a planned alteration requires a Watercourse Alteration Permit can be obtained by contacting:

John Beunders
Department of Environment
Assessment and Approvals Branch
Technical Approvals Section
PO Box 6000 Fredericton NB
E3B 5H1
506 453 7945

Woodlot owners wishing to obtain their own orthophoto map(s) may do so by contacting:

Larry Pyne
Department of Natural Resources and Energy
Public Service Branch
Room 100, Hugh John Fleming Forestry Centre
PO Box 6000 Fredericton NB
E3B 5H1
506 453 2764

March 13, 2000

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WORKING NEAR WATER:

GUIDELINES FOR NEW BRUNSWICK WOODLOT OWNERS

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Terry O'Donnell
March 1996

Additional copies of this publication are available from:
The Forest Extension Service
Department of Natural Resources & Energy
PO Box 6000
Fredericton, NB
E3B 5H1
(506) 453-3711 FAX (506) 444-4362

Forest Extension provides a variety of services to woodlot owners, including technical advice, a publications and video library, woodlot management courses, and a free newspaper.

Foreword

The guidelines contained in this manual have been prepared to complement the Watercourse Alteration Regulation 90-80 under the New Brunswick Clean Water Act, Chapter C-6.1 They are intended to assist contractors and woodlot owners involved in forestry operations, road building, pond construction and other land use activities associated with watercourses on privately owned land in New Brunswick. These guidelines have been prepared by the Forest Extension Branch of the Department of Natural Resources and Energy (DNRE), with assistance from the Fish and Wildlife Branch (DNRE), the Department of the Environment, the Department of Fisheries and Aquaculture, and the Department of Fisheries and Oceans. Major funding for this project was provided under the Canada/New Brunswick COOPERATION Agreement on Forest Development.

The guidelines are presented in two parts. Section 1 contains guidelines relating to general types of watercourse alterations, such as culvert installations and bridge construction, which require regular Watercourse Alteration Permits. The guidelines within this section are a collection of both "good" forestry practices and mandatory requirements of the Watercourse Alteration Regulation. To distinguish between the two, **environmental guidelines which represent current government policy or are a "condition of approval" of Watercourse Alteration Permits are shown in bold print.** Recommended forestry practices have been left in regular print.

Persons using this manual should note that conditions of approval issued with Watercourse Alteration Permits will vary from one type of watercourse alteration to another, depending on the specific circumstances of that alteration. A Watercourse Alteration Application Form and examples of Watercourse Alteration Permits, including their conditions of approval, are provided in Appendices A and B.

Section 2 deals with a special type of Watercourse Alteration Permit referred to as a "Provisional Permit". Provisional Permits apply to 11 types of minor watercourse alterations which the Department of Environment has determined "will not significantly affect the environment if carried out in accordance with prescribed conditions." A Provisional Permit Notification Form can be found in Appendix C.

It should be noted that special conditions apply outside the normal requirements of Provisional or Watercourse Alteration Permits if the work you're planning is to occur in one of the province's 31 specially Designated Surface Watersheds. An explanation of this program and a map showing the location of protected watersheds is provided in Appendix D.

The environmental guidelines described in this publication are intended to provide standards and practical advice for minimizing disturbance to the natural environment; they are not to be interpreted as a method of design. Following these guidelines does not:

(1) Place liability for the design, planning, or construction of any watercourse alteration on the government of New Brunswick;

(2) Exempt a person from any liability for any damage resulting from a watercourse alteration;

(3) Exempt a person from the need to obtain a Watercourse Alteration or Provisional Permit.

Regualations and policies relating to the Clean Water Act are subject to changes. The information in this manual was current in March, 1996.

For further information about the Watercourse Alteration Regulation and its environmental requirements, or to obtain a Watercourse Alteration or Provisional Permit application form, contact your local Department of Natural Resources and Energy office, or:

N.B. Department of Environment
P.O. Box 6000, 364 Argyle Street
Fredericton, New Brunswick
E3B 5H1

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Section 1

Environmental Guidelines and Watercourse Alteration Permits

1.0 Introduction

Under the Watercourse Alteration Regulation of the Clean Water Act, a **watercourse is defined as:**

"The full width, and length, including the bed, banks, sides and shoreline, or any part, of a river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, the primary function of which is the conveyance or containment of water, whether the flow be continuous or not" (Figure 1).

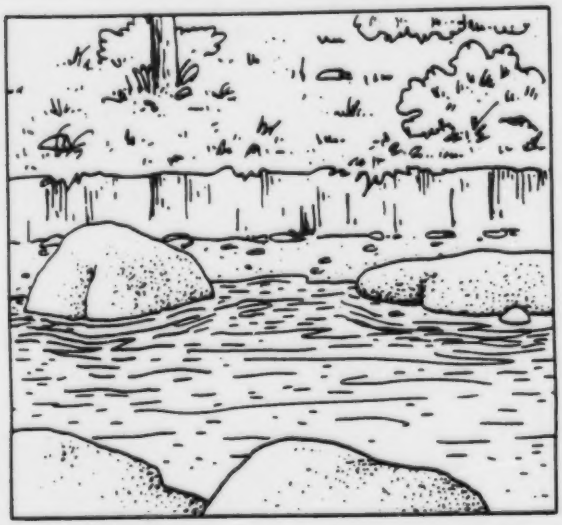


Figure 1. Under the Watercourse Alteration Regulation, a watercourse is considered to be any natural or man-made body of water, the primary function of which is the conveyance or containment of water, regardless of whether the flow is continuous or not.

Before any temporary or permanent changes can be made at, or to, a watercourse, or to water flow in a watercourse, the person or persons making this alteration must obtain a Watercourse Alteration Permit. Information packages containing Watercourse Alteration Application Forms can be obtained from any Department of Natural Resources and Energy office or:

Environmental Planning and
Sciences Branch
N.B. Department of the Environment
P.O. Box 6000, 364 Argyle Street
Fredericton, New Brunswick
E3B 5H1

1.1 Activities which require a permit

The activities near a watercourse which have been specifically identified as requiring a permit are:

1. **Any change made to existing structures in the watercourse, including repairs, modifications or removal, whether the water flow in the watercourse is altered or not.**

2. **The operation of machinery on the bed of a watercourse, other than at a recognized fording place.**

A recognized fording place means a ford as indicated on the most recent 1:50,000 scale maps of the national topographic system, or a place where persons have forded a river, stream, creek, or other body of flowing water for at least five consecutive years.

Fords must have stable approaches and a stable streambed to prevent sediment from entering the watercourse.

3. **Any deposit or removal of sand, gravel, rock, topsoil or other material into, or from, a watercourse or within 30 metres (100 ft) of the bank of a watercourse.**

4. **Any disturbance of the ground within 30 metres (100 ft) of the bank of a watercourse, except grazing by animals, the tilling, plowing, seeding and harrowing of land, the harvesting of vegetables, flowers, grains, and ornamental shrubs and any other agricultural activities prescribed by regulation for the purposes of this paragraph, that occur more than 5 metres (15 ft) from the bank of a watercourse.**

5. **Any removal of vegetation from the bed or bank of a watercourse.**

6. **Any removal of trees within 30 metres (100 ft) of the bank of a watercourse.**

1.2 Activities exempt from a permit

There are a limited number of activities exempt from obtaining a Watercourse Alteration Permit, even though they fall under the definition of a watercourse alteration. Those applicable to woodlots are:

1. **Repair of a project or structure under subsection 15(3) of the Act if no modification is made to the size, shape, materials, and alignment of the structure.**

2. **The construction of a roadway, railway, or agricultural ditch if there is no danger of pollution as a result of the construction and subsequent operation of the ditch and if the ditch does not break the banks of a watercourse.**

3. **The maintenance of a roadway, railway or agricultural ditch if:**

(a) the ditch does not break the banks of a watercourse;

(b) no change is made to the alignment of the ditch;

(c) there is no danger of pollution as a result of the maintenance.

4. **The construction of a pond if:**

(a) the pond is not connected to or intersecting a watercourse;

(b) the pond is not within 30 metres (100 ft) of a watercourse; and

(c) there is no danger of pollution or risk to human life as a result of the construction and subsequent operation of the pond.

5. **The installation of drain tile outlets for agricultural land, provided they follow the standards agreed upon by the Department of Agriculture.**

6. **The construction of seasonal wharfs which are required to be removed prior to freeze-up provided their installation does not require any construction or excavation activity in the watercourse.**

1.3 If you don't comply

Watercourse Alteration Permits are issued on the condition that certain guidelines or "conditions of approval" are followed by the person or organization to whom the permit is issued. If these conditions are not met, the watercourse alteration can be stopped by an inspector appointed by the Minister of Environment and the person responsible for the alteration held liable.

Fines under the Clean Water Act are:

1. Individuals - minimum fine, $500; maximum fine, $50,000.

2. Persons (municipalities, corporations) - minimum fine,$1,000; maximum fine, $1,000,000.

2.0 General environmental guidelines

Two categories of environmental guidelines, or "conditions of approval", apply to Watercourse Alteration Permits. The first are called general guidelines because they are mandatory to all types of watercourse alteration projects. These include:

1. **Machinery and pollutants must be located or stored in areas not in danger of floodwater. Machinery in use shall be located so that in case of a flash flood, it can be removed from the flood areas.**

2. **All necessary precautions shall be taken to prevent the discharge or loss of any harmful material or substance into the watercourse including, but not limited to, creosote, hydrocarbons, pesticides, fresh cement, lime, paint, or concrete.**

3. **Any debris and excavated material resulting from the construction process shall be removed from the watercourse and adjacent areas, and be disposed of, or placed in a manner, where it cannot be returned to the watercourse. Sites should be cleaned up and stabilized against erosion.**

4. **If any equipment is used in the watercourse, it must be mechanically sound, having no leaking fuel tanks or hydraulic systems, and be steam cleaned free of petroleum products and dirt.**

5. **No washing of tools, forms, or machinery may occur in, or adjacent to, a watercourse.**

6. **All work operations must be done in such a way that sedimentation of the watercourse and disturbance to the project area is minimized.**

7. **If the banks of the watercourse are disturbed by any activity associated with a project, they must be immediately stabilized to prevent sedimentation.**

8. **No soil shall be disturbed during any period when it is saturated with water.**

9. **The permittee must take the necessary precautions to ensure public safety.**

Other conditions of approval issued with Watercourse Alteration Permits are specific to the type of watercourse alteration being done. For the purpose of this manual, they have been grouped with various "good forestry" practices and divided into the following categories — forestry operations near streams, woodlot road construction, temporary crossings, extraction trails, and pond construction.

3.0 Forestry operations near streams

The following guidelines reflect the current policy of the Department of Environment with regards to forestry operations such as harvesting, pre-commercial thinning, skidding, etc., near streams on private woodlots.

Generally, guidelines for activities near streams having a channel less than 0.5 metres (1.6 ft) in width are less restrictive than those for larger streams. Channel width, bank to bank, is defined as the straight line distance from the normal high water line on one side of the stream to such a mark on the opposite side of the channel. The normal high water line is that line along the shore of a watercourse which is apparent from visible markings and changes in soil characteristics due to the prolonged action of water or changes in vegetation (Figure 2).

3.1 Streams less than 0.5 metres (1.6 ft) in width

1. **Streams less than 0.5 metres (1.6 ft) in width do not require a 30 metre (100 ft) restricted harvest zone for forestry operations.**

In other words, harvesting and thinning operations will be allowed up to the banks of streams less than 0.5 metres (1.6 ft) in width without the requirement for a permit. Activities which impact on these watercourses, though, will be considered violations.

2. Streams less than 0.5 metres (1.6 ft) wide:

(a) **cannot be filled with slash,** such as during harvesting and thinning;

(b) **cannot be travelled across with mechanical equipment** such as skidders, forwarders, tractors, etc.;

(c) cannot be travelled within 3 metres (10 ft) of their banks by heavy machinery;

(d) **require a Watercourse Alteration Permit to install a permanent crossing.** ***Streams with channels less than 0.5 metres (1.6 ft) in width are still considered a watercourse and are subject to all requirements of the Clean Water and Fisheries Act.***

3.2 Streams 0.5 metres (1.6 ft), or greater, in width

1. **Streams 0.5 metres (1.6 ft), or greater, in width are subject to all regular conditions of the Watercourse Alteration Regulation.**

2. The only exception to this is pre-commercial thinning. **The current policy of the Department of Environment is to allow pre-commercial thinning up to the banks of watercourses without a permit, if:**

(a) the canopy over the watercourse is not disturbed or reduced;

(b) no slash or trees are felled across, or into, the watercourse;

(c) the thinning is done by hand and no machinery is allowed within 15 metres (50 ft) of the watercourse; and

(d) the trees and brush cut are left in place and not removed. If removal is required for chipping, a permit is required.

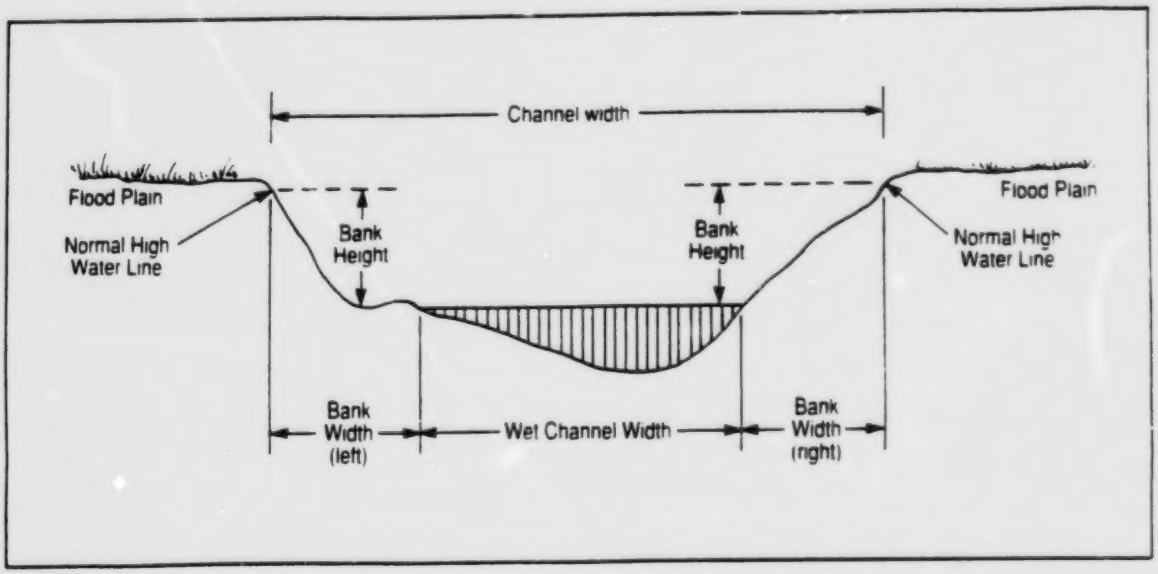


Figure 2. *Stream measurement terminology. Streams with a channel width less than 0.5 metres (1.6 ft) are subject to different environmental restrictions than larger streams.*

3. A special type of Watercourse Alteration Permit, known as a Provisional Permit, is issued for harvesting mature trees growing next to watercourses more than 0.5 metres (1.6 ft) wide, unless:

(a) applicability or condition sections, as described in the Provisional Permit cannot be met;

(b) the harvest location is in one of the provinces' Designated Surface Watersheds (see Appendix D). Harvests that do not meet the applicability or conditions sections as described under the Provisional Permit System require filing of a regular Watercourse Alteration Application.

Conditions pertaining to harvest operations within 30 metres (100 ft) of a watercourse, as required under a Provisional Permit, are described in Section 2, part 20.0 "Selective harvesting of timber within 30 metres (100 ft) of a watercourse.

4.0 Woodlot road construction

4.1 Planning and road location

Proper planning and choice of road location are essential to minimizing the potential for environmental damage due to woodlot road construction. Good planning also reduces construction costs and makes for a more efficient road system.

Road location should include the following items:

1. Begin with the selection of a tentative route on aerial photographs by a forester or forest technician. Initially this involves selecting "control points" where the road must pass, such as starting and ending points, where it must follow along a ridge, etc. The selected route should minimize the number of stream crossings and maximize the distance between the road and significant watercourses (Figure 3).

2. During road location, maintain a 30 metre (100 ft) buffer strip between the road construction area and all watercourses, except at the point where the road must cross a stream.

Within this 30 metre (100 ft) buffer strip, no harvesting or ground disturbance is to occur without a Watercourse Alteration, or Provisional Permit.

3. Where a road must cross a stream or other watercourse, it should do so at a right angle. Sites chosen as a crossing should be made where the stream channel:

(a) is narrow and straight;

(b) has little or no slope; and

(c) has stable, flat banks capable of supporting the weight of machinery to be used in establishing the crossing.

Figure 3. Woodlot road location begins with the consultation of aerial photographs and orthophoto or topographical maps. Proposed routes are then inspected to minimize construction costs and potential for environmental damage.

4. Bridges, rather than culverts, should be used at stream crossings where the choice of a culvert would require that one greater than 120 cm (48 in) in diameter must be used.

5. **Bridges or other structures that maintain the natural streambed, such as open-bottom culverts, are a requirement if the gradient of the watercourse exceeds 0.5% at the point of crossing, unless special measures are taken to create a water flow suitable for fish passage.** On fish-bearing streams, closed perimeter culverts installed at a slope greater than 0.5% must utilize fish passage facilities designed in consultation with the Department of Fisheries and Oceans.

6. Favour open-bottomed culverts or bridges over cylindrical culverts in fish-bearing streams, since they constrict the streambed less and maintain the natural stream bottom.

7. Roads should follow the contours of the land and be located along high ground, where they require fewer stream crossings and have better drainage than those located in depressions or valleys.

8. Keep road grade below 10% - a 1 metre rise or fall for each 10 metres horizontal distance (1 ft to 10 ft).

9. Long grades followed by sharp turns are prone to soil erosion; avoid them.

10. When building a road on hilly terrain, locate it across the slope of the hill. Such locations provide good cross-drainage, and fill from the cut can be used to build the roadbed, provided erosion control measures are taken to stabilize any exposed soil (Figure 4).

11. Indicate possible locations for landings, borrow pits, turn-outs, and turn-around areas on the aerial photographs as part of the initial road location process. **Any such area where soil disturbance will occur is not to be located within 30 metres (100 ft) of a watercourse, unless a Watercourse Alteration or Provisional Permit has been obtained.**

12. Once a tentative road location has been determined on the aerial photographs, walk the entire length of the proposed route and flag or otherwise mark the sides or centre line of the route on the ground.

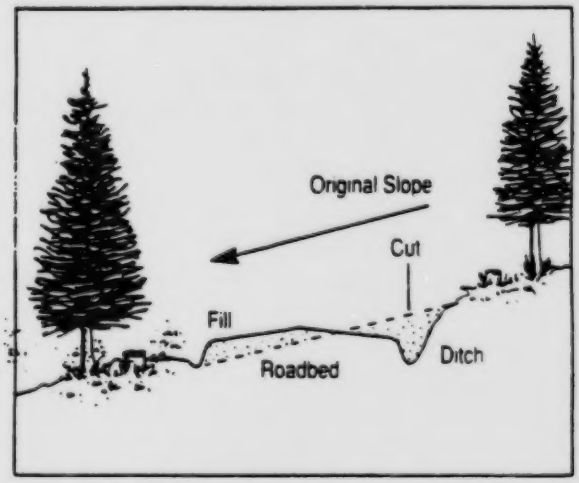


Figure 4. Locating a woodlot road across a hillside helps minimize grade through hilly terrain and allows material taken from the "cut" to be used as fill for the roadbed.

If obstacles not apparent on the aerial photographs, such as springs, ledges, and rock outcrops, are discovered, change the road's location to avoid them.

13. The "on the ground" inspection of the proposed road location should be done during the spring or fall, when water problems are most apparent.

14. Avoid sensitive wildlife habitats, such as deer wintering yards, fish spawning areas, and the nests of raptors, such as hawks, owls, osprey, and eagles. If your road must be located near a sensitive wildlife area, contact your regional Department of Natural Resources & Energy (DNRE) biologist for assistance.

15. Once the final location has been determined, you will have the necessary information to apply for any required Watercourse Alteration Permits. Permits may take up to 8 weeks to be processed and **must be obtained before the watercourse alteration activity begins.**

16. Copies of all permits and their conditions of approval must be available on site at all times during the watercourse alteration. **No watercourse alterations are to be conducted outside their stated time period**, which is generally between June 1st and September 30th. Watercourse Alteration Permits issued outside this period are subject to intensive fish habitat protection measures.

4.2 Clearing the right-of-way

Right-of-way clearing can be divided into two stages - tree felling, and grubbing.

1. During tree felling, cut out landings, push-offs, and borrow pit areas at the same time as the road right-of-way, to minimize the amount of standing timber which will be bulldozed during the road construction. Bulldozing standing timber interferes with drainage patterns and leads to soil erosion problems.

2. **Trees must not be felled into the watercourse when clearing the road right-of-way approach to a stream crossing, nor should slash or other logging debris be left where it can wash into a watercourse during periods of high water flow** (Figure 5).

If any trees or logging debris accidentally enter a watercourse, they must be removed immediately by hand or power winch.

Figure 5. Trees and logging debris should not be allowed to enter the watercourse when making the right-of-way cut.

3. **Marketable wood harvested from the right-of-way cut must not be transported across a watercourse** until a permanent crossing, such as a bridge or culvert, has been installed.

4. Right-of-way width will be determined by the class of road being built. High standard woodlot roads may have a right-of-way up to 10 metres (33 ft) in width. Lower class roads and extraction trails often require widths less than half this amount. Regardless of the right-of-way width, it should:

(a) be kept to a minimum for the class of road being built, especially at stream crossings;

(b) have its sidelines marked before road construction begins to control clearing width; and

(c) be wide enough to allow good visibility and permit sufficient sunlight to reach the roadbed.

5. Grubbing to remove stumps, roots, slash, and other unsuitable roadbed material overlying the mineral soil on the right-of-way should be done such that:

(a) grubbed materials are bulldozed into push-off areas and flattened down;

(b) debris is not left along the side of the road where it will hinder ditching and prevent the proper draining of water from the roadbed;

(c) trees are not undercut or damaged by machinery along the edge of the road right-of-way. A cleared, but not grubbed, area should be left along the outside edge of the right-of way;

(d) it does not take place too far ahead of the construction of the roadbed. This will minimize the amount of time that mineral soil is exposed to erosion;

(e) some topsoil is left in place to help ensure rapid revegetation of the right-of-way area; and

(f) no grubbing occurs within 30 metres (100 ft) of each side of a watercourse, except where necessary at crossings to remove stumps under the roadbed, and then not until construction of the crossing is to occur.

6. Non-merchantable trees and shrubs growing within the 30 metre (100 ft) no-grub zone next to a watercourse should not be cut, to minimize soil erosion.

7. **Push-offs should be located** on the low side of the road and **at least 30 metres (100 ft) from the watercourse.**

4.3 Building the roadbed

Construction of the road involves reshaping the grubbed right-of-way to the desired cross-sectional shape and dimensions for the class of road being built. Structurally, a woodlot road consists of the roadbed or foundation, roadway (travelling surface), shoulders, and ditches (Figure 6).

A layer of gravel may be used as a surfacing layer but, for most woodlot roads, the roadbed serves as both the foundation and travelling surface. Minimum width for a woodlot road is usually 4 metres (13 ft).

Guidelines for roadbed construction include:

1. Roadbeds should be built at, or above, the level of surrounding terrain, unless the road is being built through a cut, to help maintain adequate drainage.

2. Crown the roadbed to a 2 or 3% slope so that water will flow from it into adjacent ditches. A 4 metre (13 ft) wide road built to this crown would be 4 to 6 cm (2 to 3 in) higher in the centre of the road than at its shoulders.

3. Where possible, obtain fill for building the roadbed from the excavation of the roadside ditches. This saves money in construction costs and usually has the least potential for environmental damage. Ditch material can be pushed up onto the roadbed with a bulldozer, or it can be pulled in from the sides, if using a backhoe or excavator.

4. Backhoes or excavators are recommended for building the roadbed in wet soils since they provide greater control

of the type of material to be used and cause less overall soil disturbance within the right-of-way.

5. Roadbed fore and back slopes should be kept to a minimum. **Within 30 metres (100 ft) of a watercourse the maximum slope of the shoulder** (roadbed foreslope) **must be 2 horizontal to 1 vertical.** Flatter slopes are more stable, have greater resistance to erosion, and re-vegetate faster than steep slopes (Figure 7).

6. Sediment barriers, such as silt fences or hay bales, should be placed along the toe of the slope of the fill used to construct the approaches to the stream crossing.

7. Where a road must be built across a slope, or where it is to cross a watercourse, stabilize cut banks and fill slopes by seeding or with a layer of hay mulch. Seeding guidelines are provided in Appendix E. Apply hay mulch at a rate of one bale per 25 square metres (30 yd^2) and spread uniformly over the entire exposed area.

8. Construct the roadbed in shallow layers and compact the fill by running heavy equipment, such as a bulldozer, over the full width of each layer. This helps minimize road slumping and soil erosion.

9. If a surfacing layer, such as gravel, is used to top the roadbed, the **gravel must not be taken from a streambed.**

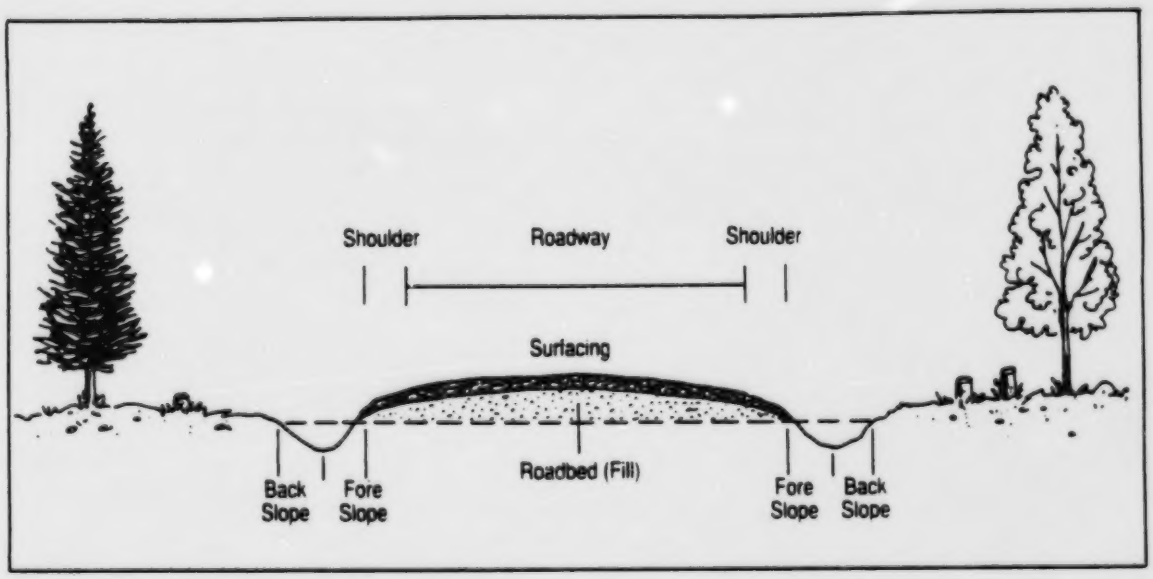


***Figure 6.** Woodlot road terminology. "Crowning", or shaping the roadbed so that it is slightly higher in the centre than its sides, encourages water to drain into the ditches thus reducing rutting and the need for road maintenance.*

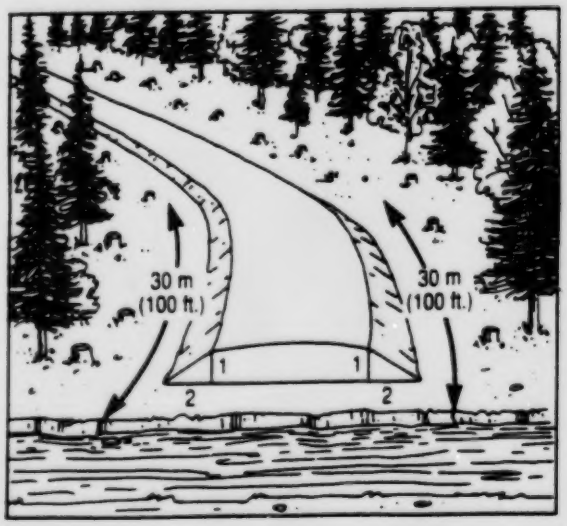


Figure 7. Roadbed foreslopes must not exceed a slope ratio of 2 to 1 within 30 metres (100 ft) of a watercourse.

10. Create a small dip in the roadbed above the no-grub zone at stream crossings, to direct water running down the road into the ditches before it enters the stream, and to protect the road from washout during flooding.

11. Avoid roadbed construction during early spring and late fall when the risk of soil erosion and stream siltation is greatest.

4.4 Ditching

Ditches ensure a woodlot road stays dry and in a usable condition. Ditches intercept water draining onto a road from the surrounding topography, and collect and carry away water which has fallen onto the roadbed.

Two types of ditches - "roadside" and "off-take" - are used during woodlot road construction.

1. Roadside ditches run parallel to the roadbed and, on roads built on flat or gentle terrain, should be used on both sides of the road, except within 30 metres (100 ft) of a watercourse.

2. Woodlot roads built along a hillside require only one roadside ditch, which is built on the uphill side of the road, to intercept seepage and runoff.

3. Ensure roadside ditches are large enough to handle the maximum anticipated runoff. Build them at the same grade as the road, so that water flows through rather than collects in them.

4. **Do not allow roadside ditches to directly discharge into a watercourse.**

5. In certain situations, roadside ditches may require special erosion control measures. Riprap lining, for instance, reduces erosion and roadbed undermining where ditch excavation has exposed spring seeps.

Riprap, timber, or hay-bale check dams slow water speed in ditches, and reduce soil erosion and stream siltation. They are especially effective on long grades before stream crossings where ledge or other topographical features prevent roadside ditches from being diverted into off-take ditches.

6. Use off-take ditches before stream crossings to divert water into settling areas or vegetated "filter strips", so that silt is filtered out before it can enter the watercourse. Where topography permits, off-take ditches should be dug on both sides of the road at watercourse crossings. **Do not locate off-take ditches closer than 30 metres (100 ft) to a watercourse** (Figure 8).

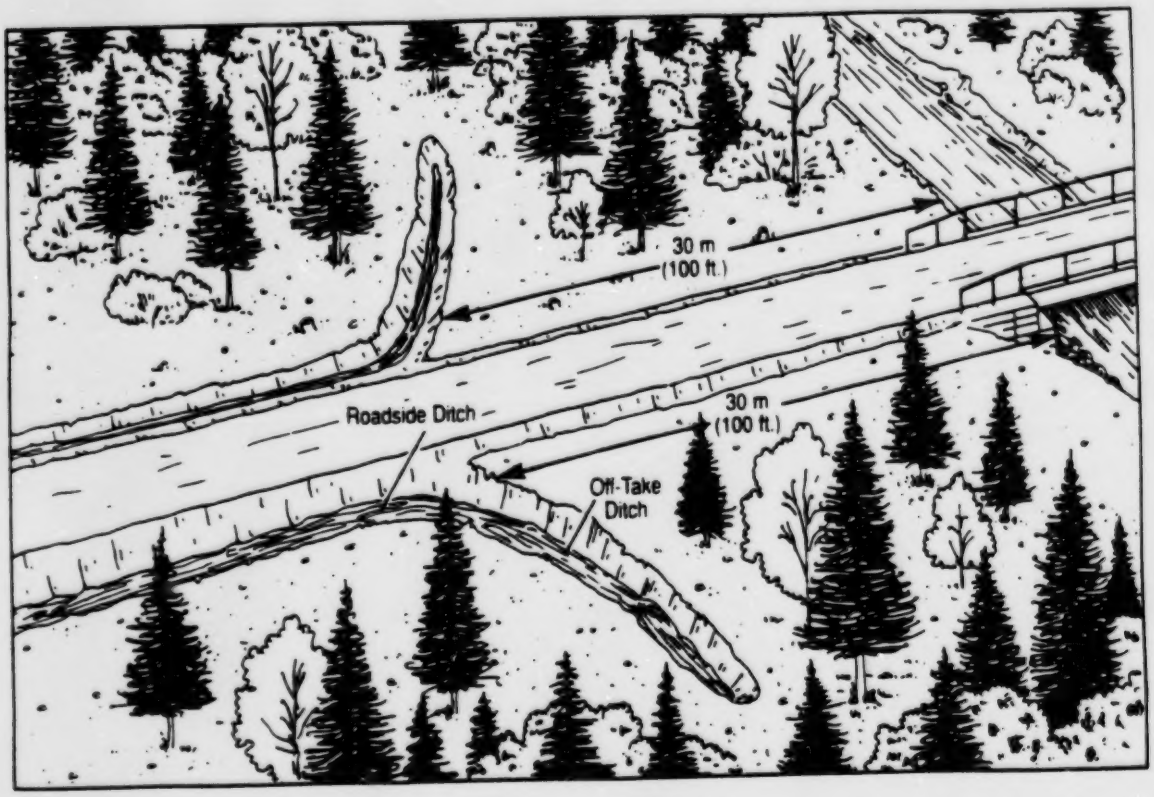


Figure 8. Off-take ditches divert runoff into settling areas before watercourses. Locate them at least 30 metres (100 ft) from the watercourse.

7. Use off-take ditches along roads built down grades, especially before stream crossings, to reduce roadbed erosion and stream siltation by preventing excessive buildup of ditch water flow. **Spacing of off-take ditches along roads built down a gradient is determined by dividing a variable by the slope of the road in percent.** Generally, the figure used is 500 metres (1640 ft). For example, using this value, a road with a 5% slope should have off-take ditches located at 100 metre (328 ft) intervals.

$$\text{Off-take ditch spacing} = \frac{\text{variable}}{\text{\% road slope}}$$

$$= \frac{500 \text{ metres } \%}{5 \%}$$

$$= 100 \text{ m (328 ft)}$$

4.5. Cross-drainage culverts

Cross drainage culverts are installed to allow runoff which has collected in a roadside ditch to continue its flow through the ditch at a road junction, or to pass under and away from the roadbed at a selected location. Since cross drainage culverts are not installed in a watercourse, their installation does not require a Watercourse Alteration Permit. However, cross drainage culverts may be subject to specific conditions under a Watercourse Alteration Permit if they are being installed as part of a watercourse alteration activity, such as an instream culvert installation.

Cross drainage culverts are useful in preventing the buildup of excessive water flow in roadside ditches. Diverting ditch flow to the low side of the road with cross drainage culverts reduces roadbed erosion and the potential for siltation.

1. **Spacing intervals for cross drainage culverts are determined in the same manner as for off-take ditches:**

$$\text{Cross drainage culvert spacing} = \frac{\text{variable}}{\text{\% road slope}}$$

$$= \frac{500 \text{ metres}/\%}{5\ \%}$$

$$= 100 \text{ m (328 ft)}$$

2. On roads which follow along a sidehill before a watercourse crossing, install cross drainage culverts so that they: (Figure 9)

(a) **are at 30° angle down slope to the roadbed,** allowing water to flow more readily through the culvert, and thus be diverted away from the roadbed;

(b) have a "groin" or water diversion built in the ditch at the culvert inlet to deflect water into it. The groin should be fronted with riprap to prevent its erosion or undermining of the culvert;

(c) are placed with the culvert bottom at the same level as the ditch bottom and at an approximate slope of 4%, to prevent sediment buildup that will reduce water flow. A 4% slope is equal to a rise or fall of 4 cm for every metre of culvert length (0.5 in rise or fall per linear foot).

3. Cross drainage culvert diameter should be determined by the opening needed to handle peak water flows. **The minimum diameter opening for cross drainage culverts is 30 cm (12 in).** Square-ended culverts of equivalent size would require a minimum opening size of 30 cm by 30 cm (12 in by 12 in).

4. Clean debris annually from cross drainage culverts, especially those having an open top, to prevent blockage and possible washout or flooding of the roadbed.

4.6 Instream culverts

Instream culverts are installed where a road must cross a stream. Their installation can be broken down into planning, location, design and installation stages.

4.6.1 Planning

1. **A Watercourse Alteration Permit is required for instream culvert installations** and should be applied for at least 8 weeks before the culvert is to be installed.

2. Generally, **instream work related to culvert installation is restricted to between June 1st and September 30th.** This reduces the potential for fish habitat damage such as obstructing fish migration and damaging spawning areas. Permission may be granted for installing instream culverts outside this time period, but is done so only under extensive habitat protection measures.

3. Culvert(s) of the appropriate size(s) or all culvert building materials should be on hand when construction of the stream crossing begins.

4.6.2 Location

1. Minimize the need for instream culvert installations by careful road location using aerial photographs, orthophoto, and topographical maps. Follow up the location of a tentative route on maps or aerial photographs with an "on the ground" inspection of the proposed route during the spring or fall when water drainage problems are most noticeable. Obtain the assistance of a qualified forester or forest technician during the road location process.

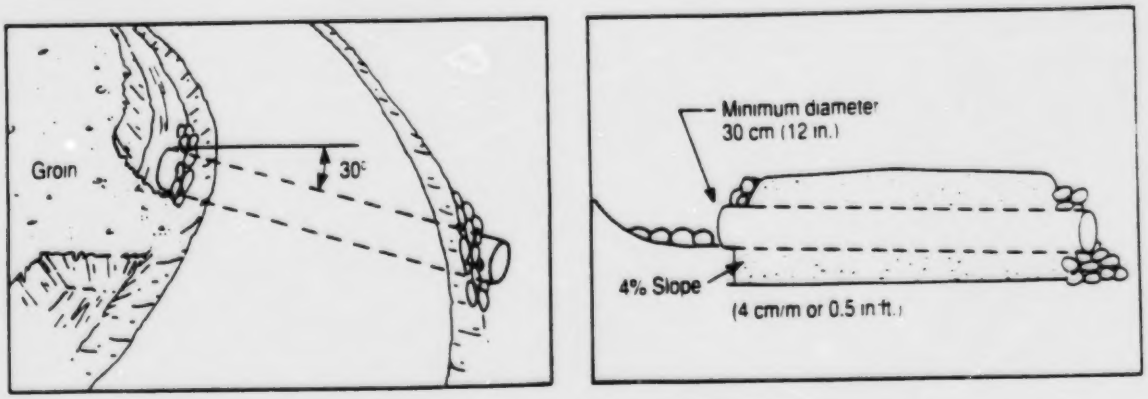


Figure 9. *A cross-drainage culvert being used to direct runoff under, and away from, a woodlot road located across a hillside. Angle to the roadbed, slope, and culvert diameter are key installation considerations.*

2. Where a road must cross a stream, the crossing should be made:

(a) at a right angle to the stream;

(b) where the approach has minimal grade;

(c) where the stream is straight, narrow, and has stable banks capable of bearing the weight of a tractor or backhoe; and

(d) where the stream gradient is as close to 0 as possible.

4.6.3 Design

Design considerations for instream culverts include culvert type, construction materials, and culvert length and diameter size.

Culvert types include circular pipes, elliptical pipes, arch culverts which rest on two side footings, box culverts with closed or open bottoms, and box culverts with tie-backs (Figure 10).

1. Steel, plastic, concrete, and wood are the preferred materials for culvert construction. Home-made culverts built from water heaters or barrels are not recommended due to their susceptibility to rusting.

2. Build wooden culverts with squared, not rounded timbers, since roundwood leaves cracks which do not adequately prevent soil placed next to the culvert from entering the watercourse.

3. Open-bottomed box culverts installed in soft ground situations should have cross-pieces installed approximately every metre (3 ft) to minimize sinkage.

4. Do not use pressure-treated lumber, such as that treated with creosote or pentachlorophenol (pentox), below the normal high water line when building an instream culvert.

Lumber used above the normal high water line which has been pressure-treated with materials such as chromated copper arsenate must be cured on dry land in such a manner as to expose all surfaces to the air for a period of at least 21 days prior to construction.

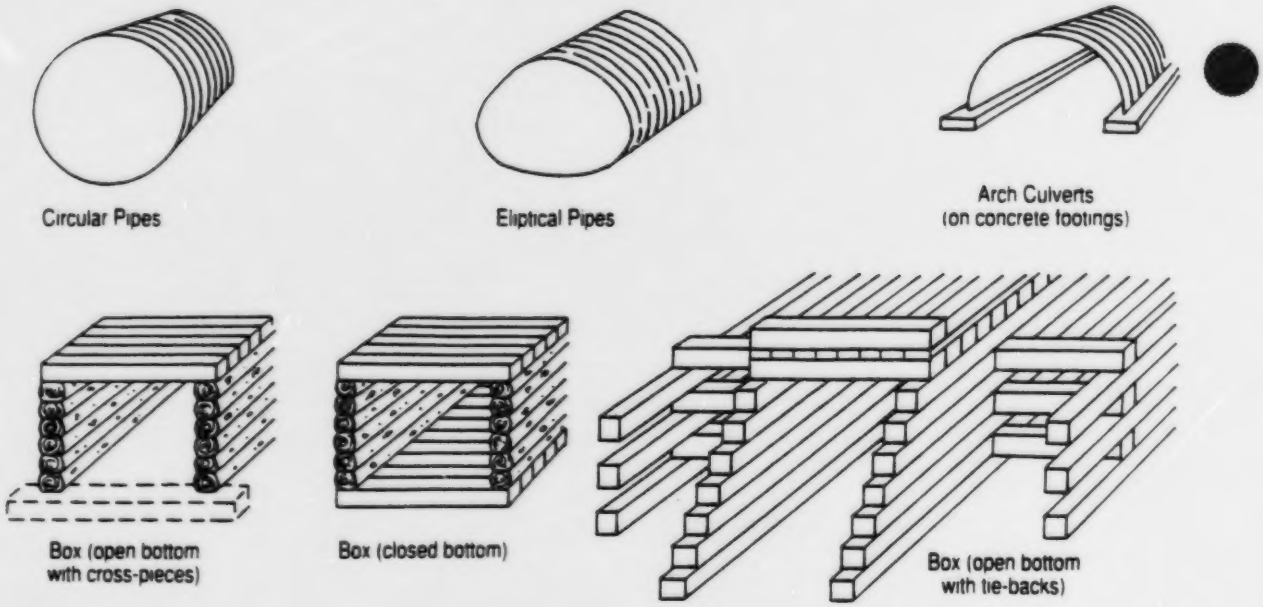


Figure 10. Alternative culvert types.

5. Culvert size is based on expected peak flow per specified time interval and is determined using hydraulic formulae. Instream culverts must be large enough to handle peak water flows, so as not to cause upstream flooding or washout of the road. Peak flows usually occur in the spring and are influenced by the amount of area draining to the stream above the crossing, the slope of this land, soil type, and precipitation amounts.

Contact your local Forest Extension representative or Department of Environment office for help when determining culvert opening size.

6. **The minimum diameter opening for culverts installed in fish-bearing streams is 75 cm (30 in).**

Square-ended culverts require a minimum opening size of 75 cm by 75 cm (30 in by 30 in) (Figure 11).

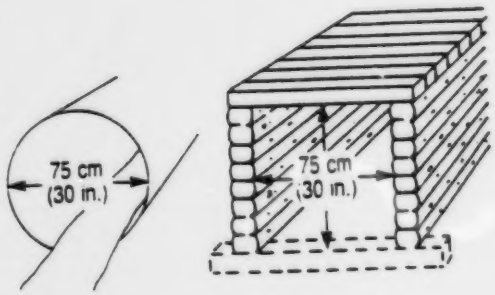


Figure 11. Minimum instream culvert size.

7. Culverts should generally not exceed 1.2 metres (48 in) in diameter. Open-bottomed culverts or small bridges are recommended for larger streams.

8. **Extend the culvert a minimum of 0.3 metres (1 ft) beyond the upstream and downstream toe of fill placed around the structure.** The exact length will depend on the culvert's diameter, the depth of fill over the culvert, the road's foreslope angle, and culvert's "skew angle" or angle between the road and the stream. Refer to Appendix F for a culvert length formula.

4.6.4 Installation

Culvert installation can be broken down into two stages - preparing the approach to the stream and the actual installation of the culvert into the streambed. Environmental guidelines relating to approach preparation are described in sections 4.2 Clearing the Right-of-way, 4.3 Building the Roadbed, and 4.4 Ditching. The following guidelines pertain specifically to the installation of the culvert into the streambed once the approach has been properly prepared.

1. Excavators and backhoes are preferred over bulldozers since they create less disturbance of the streambed. **Do not station machinery in the wetted portion of the channel while carrying out the culvert installation.**

2. All construction equipment used in the culvert installation must be mechanically sound to avoid leaks of oil, gasoline and hydraulic fluids. Do not service or wash heavy equipment next to a watercourse.

3. **Machinery or pollutants must not be left in areas subject to flooding** during the culvert installation.

4. **The work site must be isolated from the flow of water during the culvert installation so that stream siltation is minimized.** Water control methods for instream culvert installations include:

(a) **Stemming the flow upstream of the culvert location with a temporary dam and pumping the flow around the site to an area immediately downstream of the work area** (Figure 12). This involves:

(i) construction of cofferdams at the upstream and downstream ends of the culvert installation;

(ii) establishment of a pumping system for the constant pumping of water around the site into the stream at a location immediately downstream of the work area. The discharge rate of the pumping system should approximate the natural flow rate of the stream. Backup pumps should be available;

(iii) installation of the culvert, backfilling, and appropriate erosion control measures;

(iv) removal of the cofferdams and pump. This method should only be used under low flow conditions. On fisheries streams, pumping must be carried out 24 hours a day.

(b) **Constructing a temporary lined diversion channel** (Figure 13). This involves:

(i) excavating a channel parallel to the existing stream channel in the dry from the downstream end. The diversion channel is excavated so that it is slightly higher than the streambed level. Earth plugs are left between the stream and the diversion channel;

(ii) placement of a liner on the bed of the excavated channel. **The diversion channel must be lined with either 6 mil plastic, geotextile, or clean rock.** If a plastic or geotextile liner is used, it should be held in place with stones, or pegged along its edges;

(iii) joining of the diversion channel to the original streambed. The earth plug at the upstream end of the diversion channel is removed last.

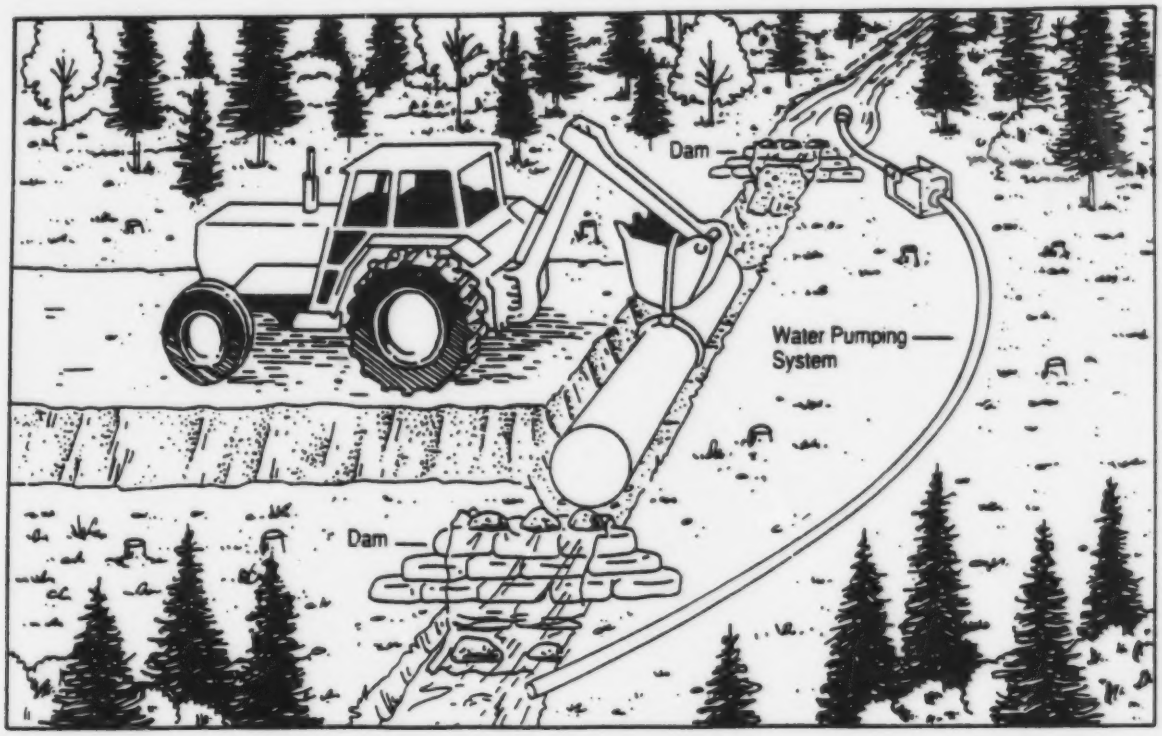


Figure 12. "Stemming the flow" method of water control. The stream is temporarily dammed and water is directed via a pumping system around the work site and back into the stream.

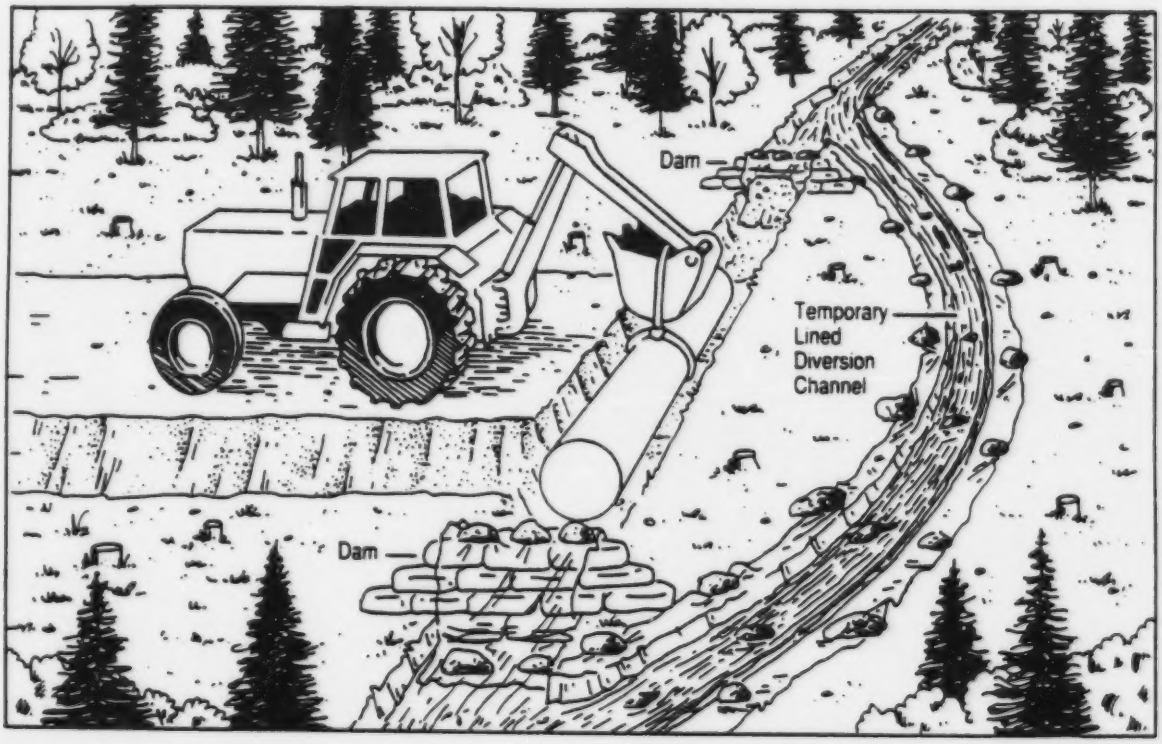


Figure 13. "Constructing a temporary lined diversion channel" method of water control. A temporary diversion channel is used to divert water away from the culvert installation site.

(iv) construction of temporary watertight structures or "cofferdams" at both the upstream and downstream ends of the work site. These isolate the work area from the stream flow and direct water flow into the diversion channel;

(v) installation of the culvert in the original channel in the dry, backfilling, and appropriate erosion control measures;

(vi) removal of the cofferdams. **Note:** Excavating the diversion channel slightly higher than the streambed level allows the water flow to naturally revert back to the original stream channel;

(vii) removal of the liner;

(viii) filling in the diversion channel beginning at the upstream end;

(c) **Building the culvert in the "dry" and diverting the stream into it upon the culvert's completion** (Figure 14).

This is a "last resort" method that involves:

(i) excavation of a channel adjacent to the existing stream channel, but not connected directly to the watercourse;

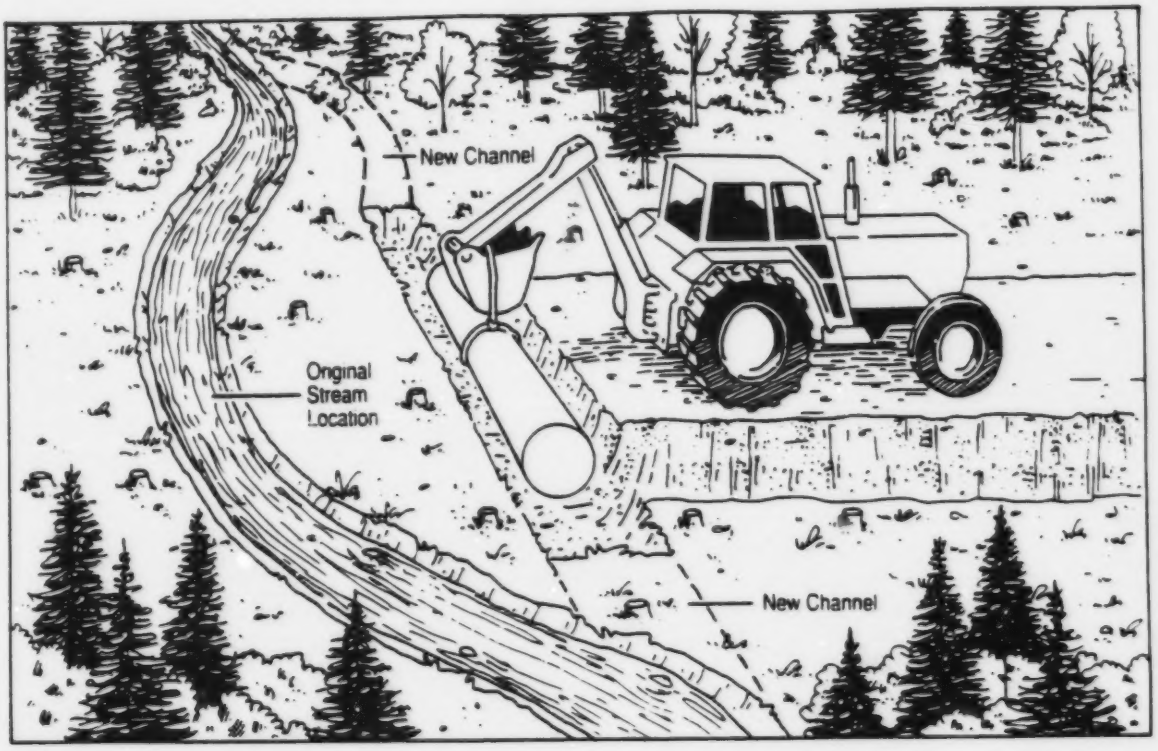


Figure 14. *"Installing the culvert in the dry" method of water control. The stream is permanently diverted into a new channel*

(ii) construction or placement of the culvert in the excavated channel, backfilling, and appropriate erosion control measures;

(iii) stabilization of the new channel against erosion, such as with a rock lining, where it leads into, and away from, the culvert;

(iv) diversion of the stream into the new channel and through the culvert;

(v) filling in the original channel beginning at the upstream end;

5. **Install culverts parallel to, and as close as possible to, the existing channel.**

6. **Place culverts on a uniform slope with the "invert",** or culvert bottom, **set at least 15 cm (6 in) below the channel bottom level at both the upstream and downstream ends.**

7. **Culvert slope should not exceed 0.5%.** This is equal to a rise or fall of 0.5 cm for every metre of culvert length (0.06 inch rise or fall per lineal foot). Where streambed slope requires a closed perimeter culvert be installed at a greater slope in fish bearing streams, fish passage facilities must be designed in consultation with the Department of Fisheries and Oceans.

8. Bridges and open-bottomed culverts are the preferred type of stream crossing structure since they preserve the natural stream velocity and are more difficult for beavers to plug than pipe culverts. Pipe culverts increase water velocity which impedes fish passage and causes scouring at the outlet.

9. In certain instream culvert installations, especially in soils prone to settlement, culverts may have to be installed with a "camber" or slight rise in the middle of the pipe.

Cambering a culvert ensures that when the roadbed settles the culvert will settle to a uniform slope. Culverts are cambered by creating a slight rise in the centre of the culvert bedding such that the middle of the pipe is raised, relative to its ends, but not enough to restrict flow. The usual camber requirement is that **the centre of the culvert be arched 2.5 cm (1 in) for every 3 metres (10 ft) of culvert length.**

10. Multiple culvert installations are discouraged from use due to their susceptibility to blockage by ice and debris. Where used, they should be confined to two culverts, **the invert of one being set 15 cm (6 in) below the existing channel bottom, while the invert of the other is set at least 15 cm (6 in) higher.**

During low flow conditions this allows water to flow through the culvert which is in the natural channel, thus maintaining fish passage. In terms of spacing, the culverts should be placed at least 1 metre (3.3 ft), or one culvert diameter apart, whichever is greater, to allow for proper tamping of fill between them.

11. **Install culverts on a firm level bottom,** preferably on a bed of gravel 15 to 30 cm (6 to 12 in) thick. If the streambed contains rocks larger than 15 to 20 cm (6 to 8 in) in diameter, they should be replaced with a bed of gravel at least 30 cm (12 in) thick. Large rocks that lay under or against a pipe culvert will damage it when equipment is driven over the culvert. If mud or other soft material is encountered at the foundation level, it should be excavated and replaced with a gravel bed at least 60 cm (24 in) in depth. Generally, the width of the excavated base for the culvert should be no wider than three times the culvert diameter.

12. **Compact fill under and at least halfway up each side of the culvert.**

Backfill should be compacted thoroughly in layers 10 to 15 cm (6 to 8 in) thick which extend a culvert diameter on each side of the culvert. Even compaction of fill on each side of a culvert gives it the support it requires. Too much fill on one side may cause it to bend out of shape.

13. There must be a certain minimal amount of fill over the culvert. Most woodlot road culvert installations **require that the elevation of the road surface be a minimum of one-half the diameter of the culvert over the top of the culvert** (Figure 15).

14. Fill placed over the culvert must not exceed a foreslope ratio steeper than 2 horizontal units to 1 vertical, unless cribbing or other form of vertical wall is used to retain the fill. In such cases the 2:1 slope requirement applies to the slope from the top of the cribbing or vertical wall to the road surface.

15. Well graded pit-run gravel with a diameter less than 5 cm (2 in) makes suitable backfill material. Soils containing clay may be used but must be carefully compacted. Backfill should not consist of mud, fine sands, or silt, large rocks, brush, and logging debris. These materials encourage washout, do not provide proper support, and may cause damage when machinery is driven over the culvert.

16. Special care must be taken to tamp the backfill along the haunches - crevices formed where pipe culverts meet the bedding. This area is where the culvert is subject to its greatest stress.

Hand tampers are suitable for tamping backfill. A length of "two by four", for example, can be used to tamp culvert haunches. For horizontal layers next to the culvert, a square board or piece of plywood about 15 cm by 15 cm (6 in by 6 in), can be added to the two by four to provide an increased tamping face area.

17. If mechanical tampers or rollers are used, avoid working too close to the culvert which might cause it to shift or lift. Fill next to the culvert should always be hand tamped.

18. **Do not obtain fill used to cover the culvert or construct the approaches within 30 metres (100 ft) of the watercourse.**

19. Fill at each end of the culvert must be protected from erosion by rock or timber walls. Where the culvert is allowed to project through the fill, riprap is used to protect the ends from erosion. Headwalls can also be used, vertical walls that parallel the road and extend back into the road embankment. Headwalls allow shorter culverts to be used and increase the volume of water a given culvert can handle. Headwalls may be built with or without wingwalls, vertical walls placed at an angle to the road. Wingwalls increase culvert cost but provide greater bank and road protection from erosion.

20. **Rip-rap and/or headwalls and wing-walls must be placed at both ends the culvert, to an elevation of at least one half of the culvert diameter above the culvert, and a minimum of one culvert diameter on each side, immediately upon completion of the culvert installation.** Additional riprap or headwall height above culvert ends may be required in certain alterations. Such material should be on good footing or it may collapse.

21. **Riprap must be a material that is clean, inorganic** (free of brush or any other logging debris), **non-ore bearing, non-toxic, and obtained from a non-watercourse source.**

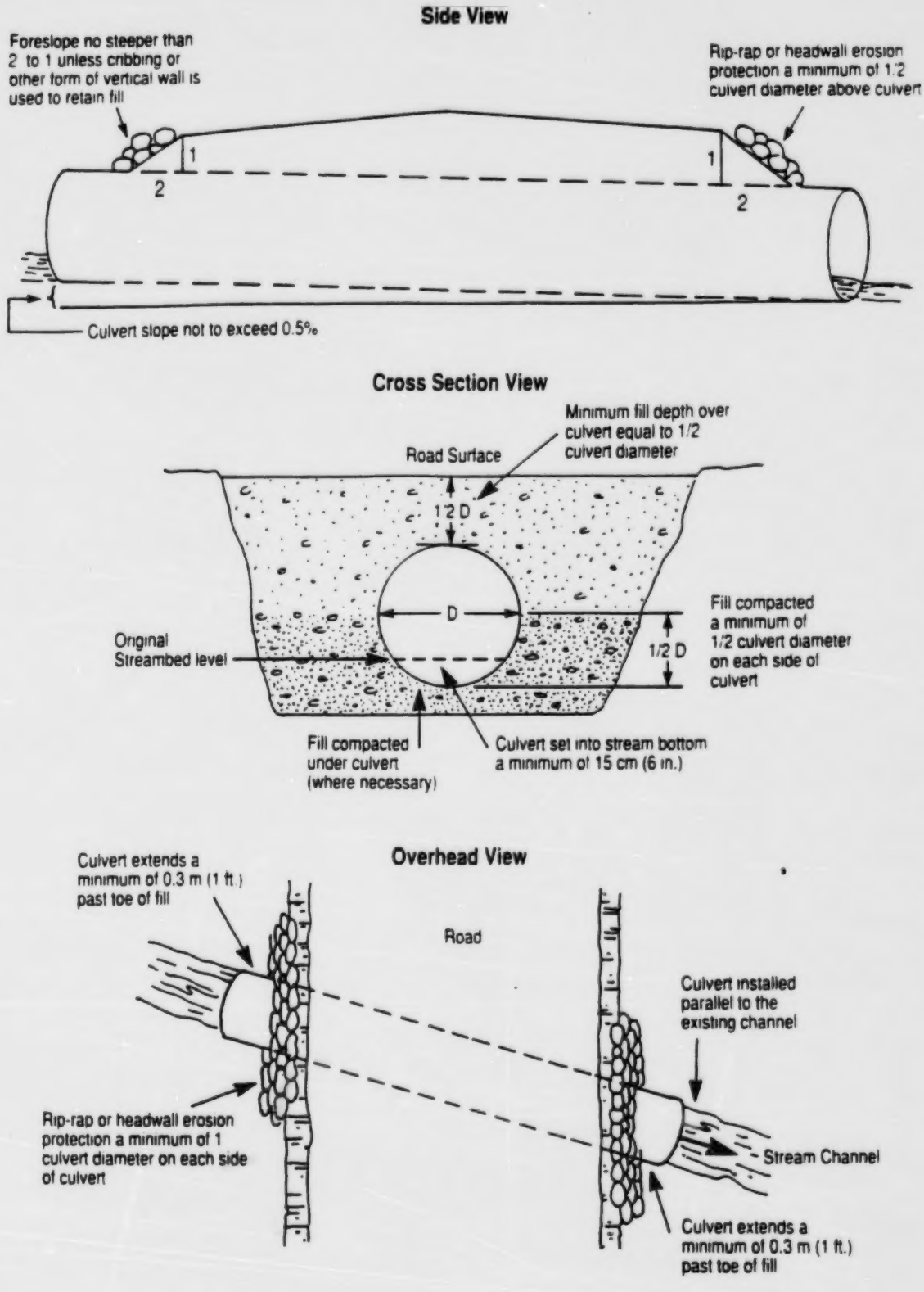

Side View
Foreslope no steeper than 2 to 1 unless cribbing or other form of vertical wall is used to retain fill
Rip-rap or headwall erosion protection a minimum of 1/2 culvert diameter above culvert
1
2
1
2
Culvert slope not to exceed 0.5%
Cross Section View
Minimum fill depth over culvert equal to 1/2 culvert diameter
Road Surface
1/2 D
D
Original Streambed level
1/2 D
Fill compacted a minimum of 1/2 culvert diameter on each side of culvert
Fill compacted under culvert (where necessary)
Culvert set into stream bottom a minimum of 15 cm (6 in.)
Overhead View
Culvert extends a minimum of 0.3 m (1 ft.) past toe of fill
Road
Culvert installed parallel to the existing channel
Rip-rap or headwall erosion protection a minimum of 1 culvert diameter on each side of culvert
Stream Channel
Culvert extends a minimum of 0.3 m (1 ft.) past toe of fill

Figure 15. Proper placement and fill techniques for instream culvert installation.

22. **In fish-bearing streams, the stream bottom and the banks at the outlet end of the culvert should be protected from scour by the water leaving it.** Scour is the erosion caused by water and ice flow in a stream channel. If rock is not naturally present in the stream, then a rock apron built of riprap having an average size of 15 cm (6 in) should be built at the downstream end of the culvert. If required, **rock aprons must be in place when the culvert or channel begins to operate and be built to the following specifications:**

Apron width	Apron length	Apron depth
3 x culvert diameter	5 x culvert diameter	half the culvert diameter

23. **All necessary precautions must be taken to prevent discharge or loss of any harmful material or substance into the watercourse including, but not limited to, creosote, hydrocarbons, biocides, fresh cement, lime, paint, or concrete.**

24. **Do not wash tools, forms, or machinery in, or adjacent to, a watercourse.**

25. Any debris and excavated material must be removed from the watercourse and adjacent areas and disposed of, or placed, in a manner where it cannot be returned to the watercourse.

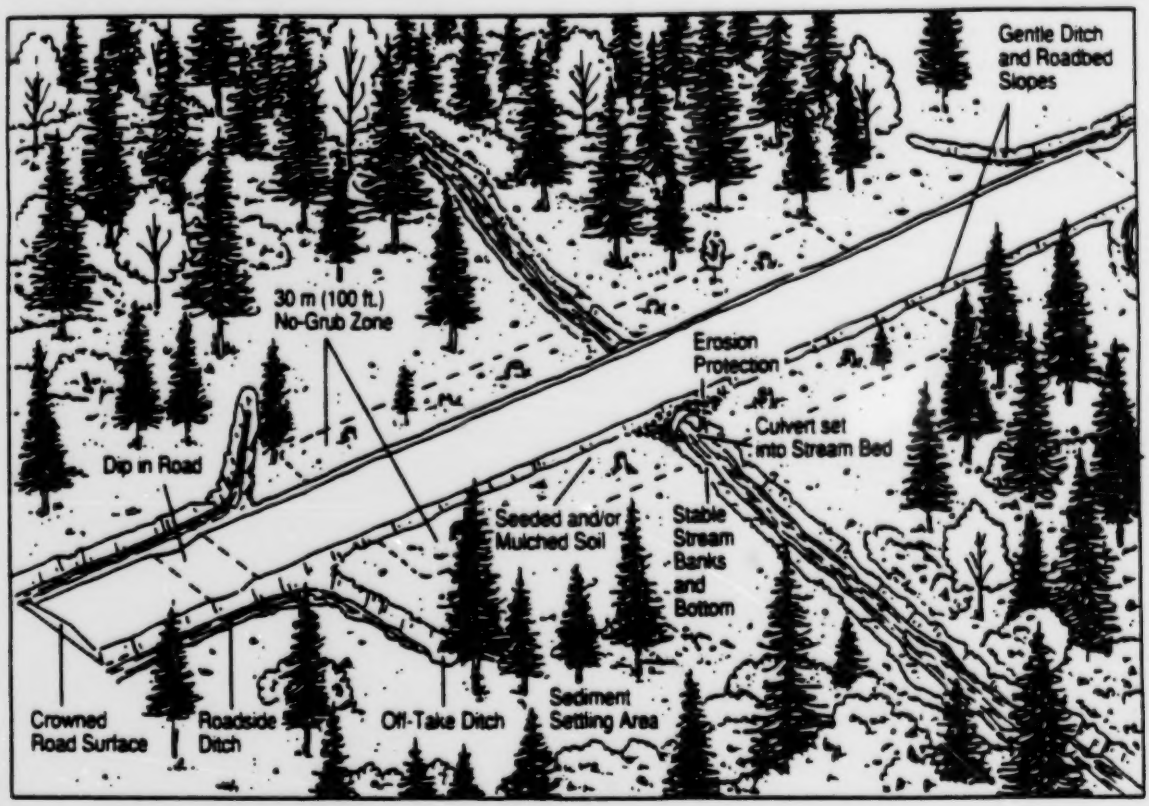


Figure 16. General features of a well-installed instream culvert.

26. **Exposed soil resulting from the culvert installation must be stabilized against erosion as soon as possible to prevent siltation of the watercourse.** If the installation takes more than one day, the exposed soil should be stabilized at the end of each day. Seeding guidelines are provided in Appendix E. Apply hay mulch at a rate of at least one bale per 25 m^2 (30 $yd^{2)}$ and spread uniformly over the entire exposed area (Figure 16).

4.7 Bridge construction

The construction of a woodlot bridge can be broken down into planning, location, design, and construction stages.

4.7.1 Planning

1. **A Watercourse Alteration permit is required and should be applied for at least eight weeks prior to the planned construction period.**

The preferred timing of the bridge construction is June 1st to September 30th, to minimize the potential for obstructing fish migration and damage to spawning areas.

2. Materials for building the bridge should be on hand and preferably piled in order of use before construction starts.

4.7.2 Location

1. Minimize the need for bridge construction by careful route selection involving aerial photographs, orthophoto, and topographical maps. It may be possible to gain access to your woodlot without building a bridge by using an alternate route.

2. Woodlot bridges are generally used to cross streams where a culvert 122 cm (48 in) in diameter, or larger, would have been required.

3. **Woodlot bridges, or other structures that maintain the natural streambed, are a requirement if the gradient of the watercourse exceeds 0.5% at the point of the crossing, unless special measures are taken to ensure fish passage.** Bridges maintain the natural streambed and cause less scour than culverts with a closed perimeter.

4. Favour bridges over culverts where the stream is subject to rapid runoff, ice blockages, or the stream bottom is soft and unable to support the culvert.

5. Where a stream must be crossed with a bridge, choose a site where the:

(a) bridge can be built at a right angle to the stream;

(b) **channel is narrow and straight;**

(c) **banks are high, straight,** and firm;

(d) approaches to the watercourse are reasonably level and straight for a minimum of 15 metres (50 ft) on both sides of the crossing; and

(e) abutments can be located at, or outside, the normal stream banks.

4.7.3 Design

Woodlot bridges consist of abutments, stringers, cross-decking, travel planking, curbs, and timber wingwalls and/or riprap (Figure 17).

Wooden abutments are of two types - simple or crib.

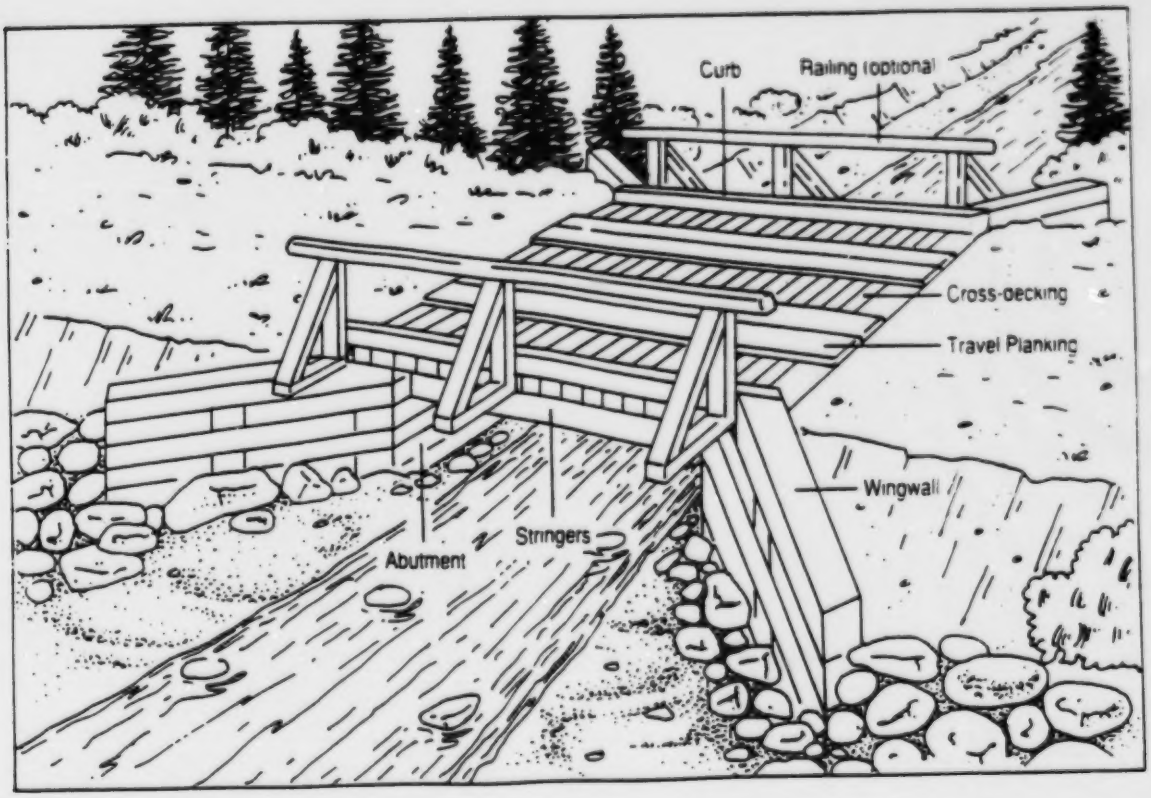


Figure 17. Basic parts of a woodlot bridge.

Simple abutments are the most basic type of woodlot bridge abutment. They consist of a single or multiple sill log laid directly on the ground on each side of the watercourse. Sill logs are usually at least 30 cm (12 in) in diameter and slightly longer than the bridge width.

Simple abutments take several forms (Figure 18).

(a) **single sill log**: This consists of a single log placed on each side of the stream in a shallow trench;

(b) **single sill log with mud sills**: This type is similar to the single sill log design except the sill logs rest on mud sills rather than the ground. Mud sills are short logs at least 20 cm (8 in) in diameter and 76 cm (2.5 ft) long placed under the sill log to give it additional support in soft soil. Sill logs are placed halfway over the mud sills to prevent uneven settlement of the bridge;

(c) **foundation logs under mud sills:** Foundation logs may be used under the mud sills to make a larger mat for extra support on especially soft ground;

(d) **multiple sill log abutments**: Three logs can be lashed together to make an abutment that gives the bridge additional height and support in soft soil. The logs should be tied together with a chain or 2.0 cm (3/4 in) wire rope at both ends and at the middle. The top log acts as the sill log. Bridges built with single or multiple sill logs usually cause less disturbance to the streambed and tend to be less costly than culverts.

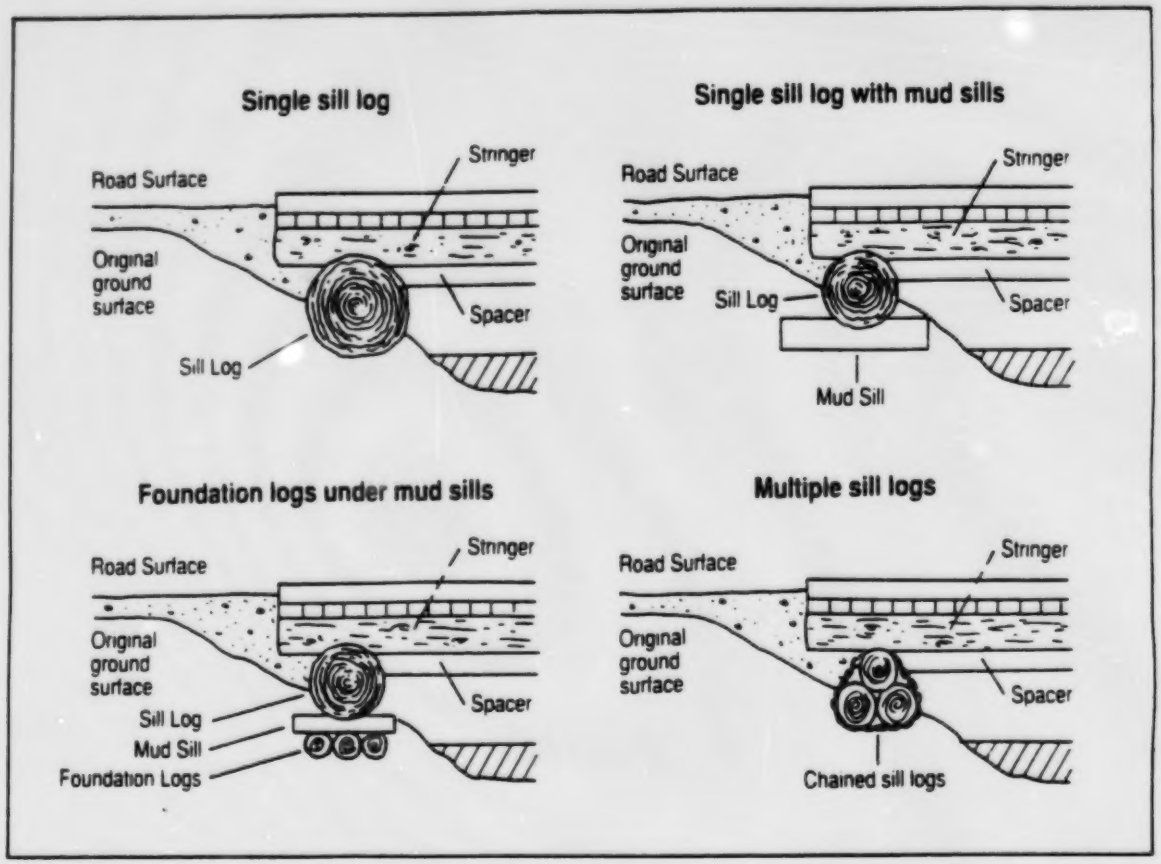


***Figure 18.** Types of simple abutments used in the construction of woodlot bridges.*

An alternative to the simple abutment is the crib abutment. Crib abutments are more complex and are used on larger streams where greater clearance over the watercourse is required. Crib abutments are built of squared timbers, often 20 cm (8 by 8 in) stock and may feature an open or closed "face". Closed faced cribbing is more effective in preventing backfill material from entering the watercourse because there are no gaps between successive timbers.

Crib abutments are either open-ended or enclosed. A commonly used type of closed-face crib abutment is the "box crib". It consists of several types of timbers (Figure 19):

(a) face timbers placed parallel to the stream;

(b) back timbers placed parallel to face timbers, but at the back of the box crib. Back timbers extend beyond the face timbers by an equal amount on each side;

(c) wing timbers connect the face timbers to the back timbers at a 45 ^{0} angle;

(d) tie-backs join the face timbers to the back timbers at a 90 ^{0} angle.

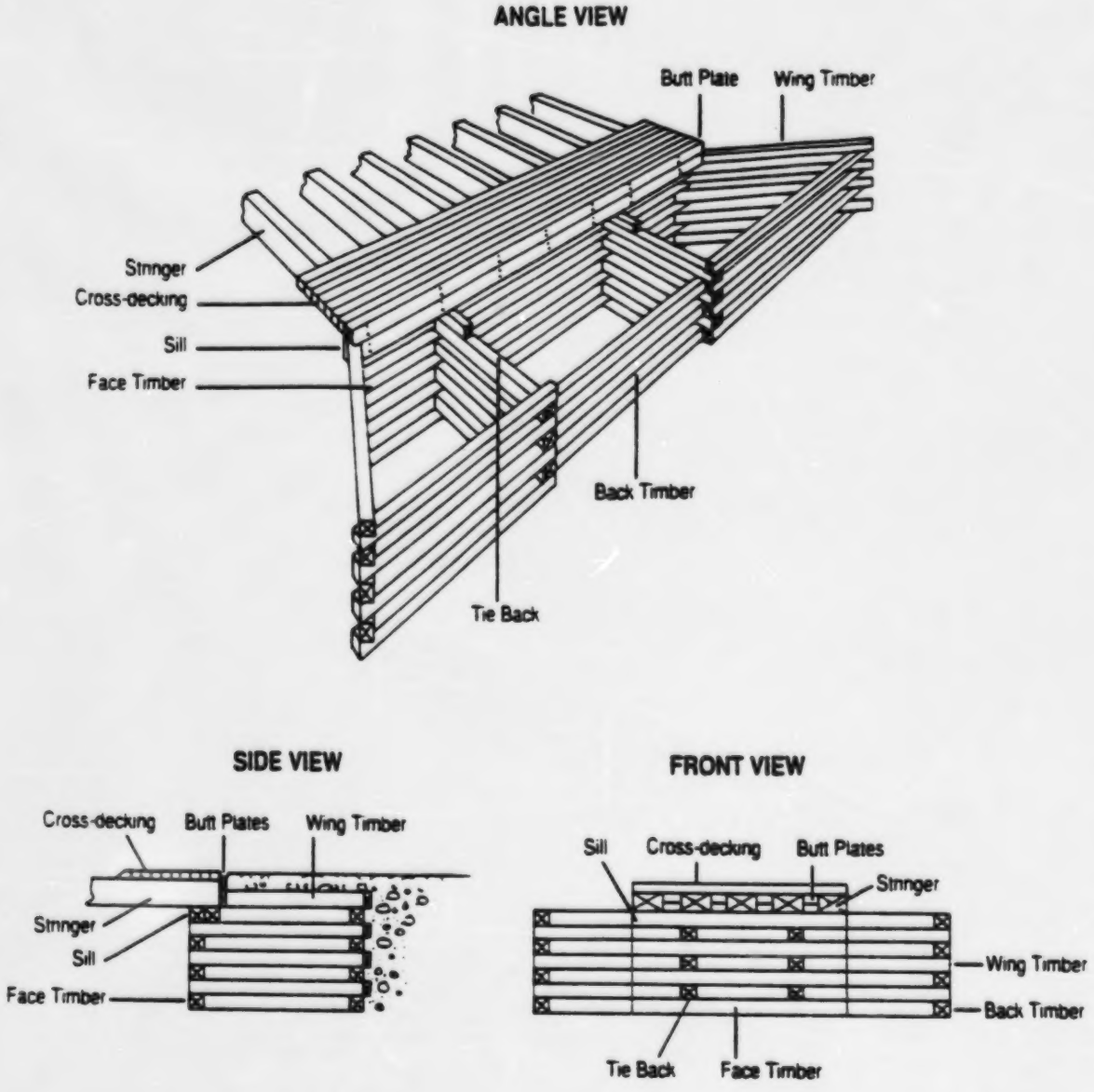


Figure 19. Typical closed-face box crib abutment construction.

Other parts of crib abutment bridges are sills and butt plates. A sill is built at the top of the crib to support the stringers. It is made by placing a second face timber, or bearing plate, just behind the top face timber. The bearing plate is bevelled flush with the wingwalls.

Butt plates are built at both ends of the stringers to prevent them from sliding over the sills. They are placed on blocking located behind the sills.

Stringers are the timbers laid across the abutments which support the weight of the bridge and the traffic it will carry. Although squared stringers are easiest to work with log stringers are sometimes used, especially with sill log abutments. Stringers are placed parallel to the direction of the road and should extend onto each abutment at least 45 cm (18 in). The exact number and size required will depend on the bridge design, but generally should not be less than 15 cm (6 in) square nor placed more than 0.5 metres (1.6 ft) apart. Use only sound, defect-free wood. Consult an engineer if your bridge requires the use of stringers in excess of 3.6 metres (12 ft) long.

Spacers are timbers attached lengthwise to the underside of stringers. They are used on bridges having sill log abutments and serve the purpose of keeping sill logs from rolling ahead.

Cross-decking is the timber placed perpendicularly across the stringers. and is often built from 10 cm (4 in) stock. Roundwood is sometimes used but can be difficult to build a level base upon which to place the travel planking.

Cross-decking should be evenly spaced along the stringers with an equal overhang beyond the outside stringers.

Travel planking refers to the boards placed on the decking which serve as a travel surface for wheeled traffic. They generally consist of 5 cm (2 in) thick lumber with two or more boards placed side by side to form "tracks" of suitable width and spacing for the type of traffic to use the bridge.

Curbing consists of a length of timber or pole laid along the outside edge of the bridge. It serves as a guide and may prevent a vehicle from sliding off the bridge if the bridge surface becomes icy.

A **railing** may also be placed along each side of the bridge as a guide for traffic. A light reflector attached to the railing is an important safety feature if you use your bridge at night.

Design requirements for woodlot bridges under the Watercourse Alteration Regulation include the following:

1. **The bridge should be built with wood having a long life span, such as squared tamarack, hemlock or similar type of wood.**

2. Pressure treated lumber, such as that treated with creosote or pentachlorophenol (pentox) should not be used below the normal high water line.

Lumber used above the normal high water line which has been pressure-treated, such as with chromated copper arsenate (wolmanized), must be cured on dry land in such a manner as to expose all surfaces to the air for a period of at least 21 days prior to construction.

3. Locate bridge abutments at, or outside, the normal stream banks. **The span should not constrict the natural flow of the water** and be sufficient size to handle expected flood flows.

4.7.4 Construction

Bridge construction can be divided into two stages - preparing the approach to the watercourse and construction of the crossing itself. Environmental guidelines related to preparing the approach for a bridge crossing are similar to those for culvert installation, and are described in sections 4.2 Clearing the right-of-way, 4.3 Building the roadbed, and 4.4 Ditching.

The following guidelines pertain specifically to the construction of woodlot bridges, once the approach has been properly prepared.

1. Do excavation work, such as digging a foundation for the abutments, by backhoe or excavator working from the bank rather than a bulldozer in the stream. **Machinery should not be stationed in the wetted portion of the channel while carrying out the project.**

2. Make sure equipment used during the bridge construction is mechanically sound to avoid leaks of oil, gasoline, and hydraulic fluids. Do not service machinery next to a watercourse.

3. During bridge construction, **do not leave machinery and other pollutants in areas in danger of floodwater.**

4. **Where excavation work,** such as for crib abutments, **is necessary in streams less than 1 metre (3.3 ft) deep at the time and location of work, a cofferdam must be constructed to divert flow to the opposite side of the channel while work is in progress.** Cofferdams help prevent siltation by isolating the work area from flowing water (Figure 20).

5. **Cofferdams shall**

(a) **consist of a layer of 6 mil sheet plastic sandwiched between an insitu wall of earth fill and an outer wall of either rocks, sandbags, or a 0.6 metre (2 ft) wide sheet of 2.0 cm (3/4 in) plywood attached to a steel H beam;**

(b) not be built of streambed material;

(c) be of sufficient height and strength to handle anticipated changes in water levels during the construction period;

(d) **be constructed so that two-thirds of the stream channel cross section is kept opened at all times;**

(e) **have water pumped from inside their work area discharged into** a settling pond or **an area of natural vegetation sufficient in length to filter out suspended solids** (i.e., silt) **before the water reenters the watercourse;**

(f) not be excavated until the cofferdam is completely closed; and

(g) **be completely removed upon completion of the project in such a way that the watercourse substrate is restored and no cofferdam material is carried downstream.** Cofferdam removal should begin at the downstream end of the cofferdam and proceed upstream to minimize water flow blockage and stream siltation.

6. Simple abutments consisting of single or multiple sill logs must be built so that:

(a) they rest on a firm foundation;

(b) they are located at, or outside, the normal stream banks to minimize instream excavation and "bottle necking" of water flow; and

(c) **their alignment does not direct water flow into the banks of a watercourse.**

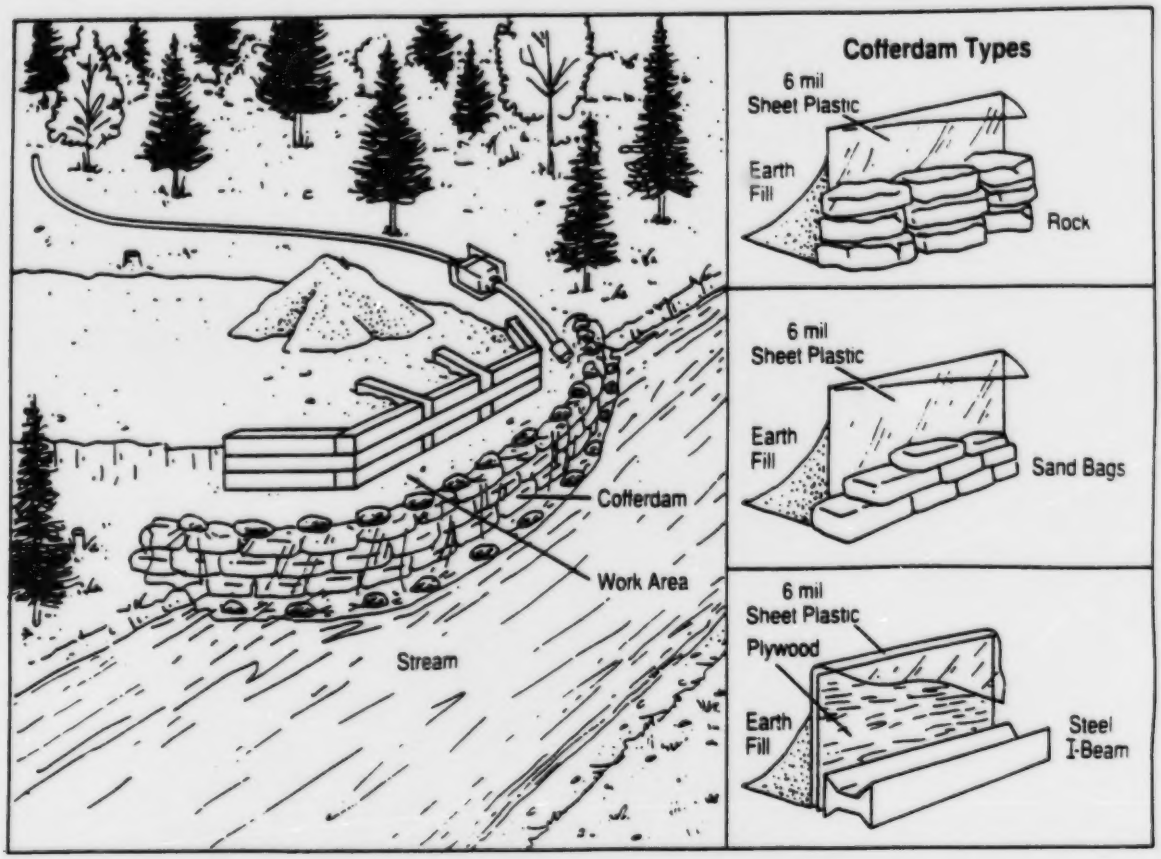


Figure 20. Cofferdam construction methods. Cofferdams prevent siltation by allowing bridge abutments to be built in an area isolated from stream flow.

7. Care should be taken during the construction of sill log abutment bridges that the sill logs are not displaced by traffic movement.

Measures which help maintain their stability include:

(a) "cradling" sill logs in a shallow trench or each side of the watercourse;

(b) spiking each stringer to the sill log in a secure manner;

(c) spiking the sill logs to the wingwalls which are help in place by tiebacks;

(d) tamping the backfill within 1 metre (3.3 ft) of the bridge abutments in 15 cm (6 in) layers; and

(e) **Attaching a length of timber known as a spacer to the underside of the outside stringers.** Spacers prevent sill logs from moving forward with the weight of vehicle traffic.

8. Crib abutments shall:

(a) rest on a firm foundation such as bedrock, rock ledge, or a layer of well compacted gravel at least 15 cm (6 in) thick. In very soft soil conditions, the foundation may have to be excavated to a depth of 60 to 90 cm (2 to 3 ft) to provide adequate footing for crib abutments;

(b) be located at, or outside, the normal stream banks to minimize the need for instream excavation and to prevent "bottle necking" of stream flow;

(c) **be aligned so that they do not direct water flow into the banks of a watercourse;**

(d) **be set below the possible depth of scour.** Scour is the movement of loose rock in the streambed due to the action of water and ice. Scour damage, or undercutting of the abutment, can be greatly reduced by setting the abutment and its wingwalls at least 30 cm (12 in) below the streambed bottom;

(e) not be backfilled with sand or silt, especially if an open-faced crib abutment. Generally, rock or gravel makes the best backfill material for crib abutments;

(f) **be constructed so that one abutment is completed before the other is started.**

9. Fording, or driving through a stream, must be kept to a minimum during the bridge construction. Fording should be limited to providing access to the opposite side of the watercourse for the purpose of constructing the bridge. The use of fords for harvesting or silvicultural operations is not recommended.

10. Fords used during the bridge construction shall:

(a) **be confined to a single location at a right angle to the watercourse, where the bed material consists of non-cohesive material, such as gravel, at least 2 cm (0.8 in) in size;**

(b) **have their approaches stabilized with evergreen boughs and tree tops to prevent silt from reaching the watercourse;**

(c) **not be used to drag or skid anything across the watercourse; and**

(d) **be used only by vehicles which are in good working condition and not losing fuel, lubricating oil, hydraulic fluids, or their cargo.**

11. **Riprap or wingwalls must be placed at both the upstream and downstream sides of the bridge to help prevent erosion.** Wingwalls, especially those used in conjunction with sill log bridges, should be held in place by tie-backs, to ensure they are not pushed into the stream by the weight of the backfill.

12. **Riprap** used during the bridge construction should be **clean, inorganic, non-ore bearing, non-toxic, and obtained from a non-watercourse source.**

13. **All necessary precautions shall be taken to prevent discharge or loss of any harmful material or substance into the watercourse, including, but not limited to, creosote, hydrocarbons, biocides, fresh cement, lime, paint, or concrete.** Chainsaws, for example, should not be operated so as to discharge sawdust and chain oil into a watercourse.

14. **Do not wash tools, forms, or machinery in, or adjacent to, a watercourse.**

15. **Any debris generated during the project should be prevented from washing downstream, and removed from the watercourse and work area and disposed of in a proper manner.**

16. **Exposed soil resulting from cut and fill operations must be stabilized against erosion as soon as possible to reduce siltation of the watercourse.** If the installation takes more than one day the exposed soil should be stabilized at the end of each day. Seeding guidelines are provided in Appendix F. Hay mulch, where used, should be applied at a rate of one bale per 25 m^2 (30 yd^2) and be spread uniformly over the entire exposed area.

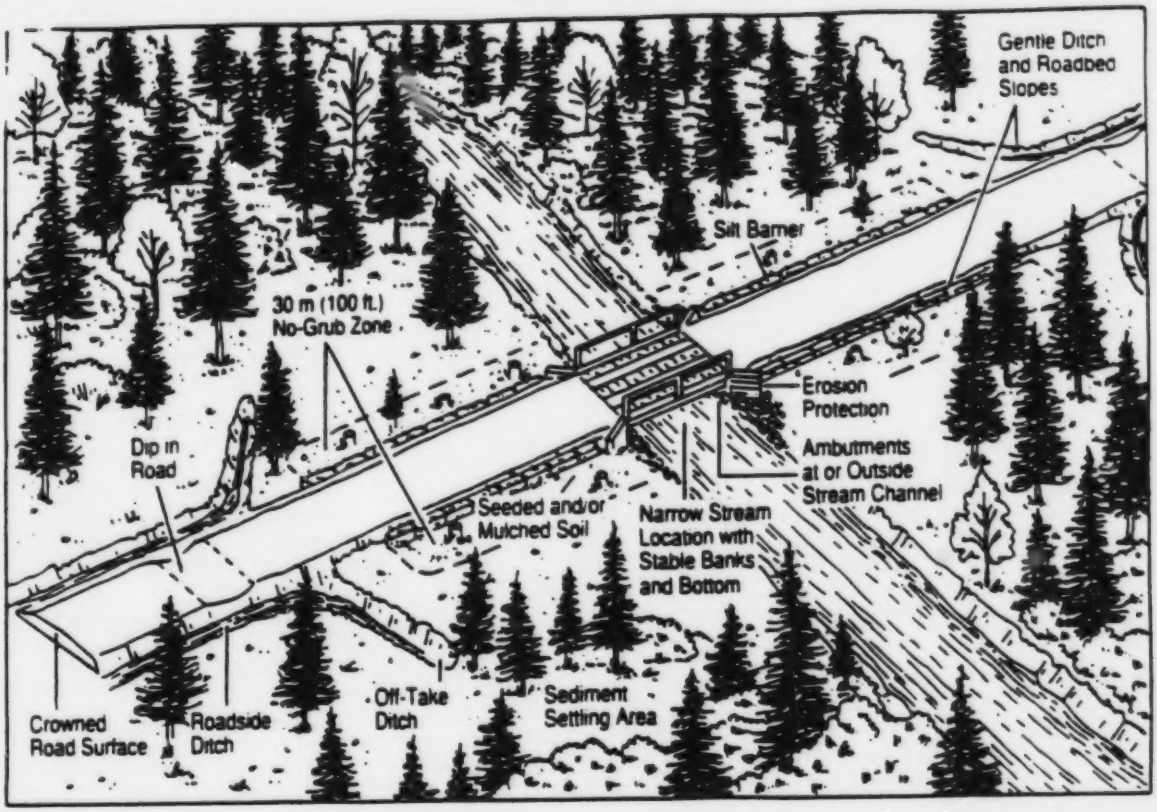


Figure 21. General features of a well-constructed bridge crossing.

17. Sediment barriers, such as silt fences or hay bales, should be placed along the toe of the slope of the fill used to construct the approaches to the bridge.

18. Every effort should be made to complete the bridge construction as quickly as possible once the work begins (Figure 21).

4.8 Road maintenance

1. Grade woodlot roads annually to fill in ruts and to maintain a crown which sheds water. This helps the road stay dry longer and reduces the potential for roadbed erosion.

2. Clear roadside vegetation back from the road right-of-way every few years to maintain access and reduce shading of the road so that it has maximum exposure to sunlight and wind (Figure 22).

3. Do not allow brush to obstruct ditches if brush control is done mechanically. If done chemically, **herbicides should not be allowed to drift or enter a watercourse.** The minimal distance that a herbicide can be safely applied next to a watercourse depends on the method of application, weather, and the type and form of herbicide used.

Always consult the manufacturer's label before applying any herbicide. Woodlot owners require a "Pesticide Applicators" license to do ground application of herbicides. Contact the Department of Environment for further information.

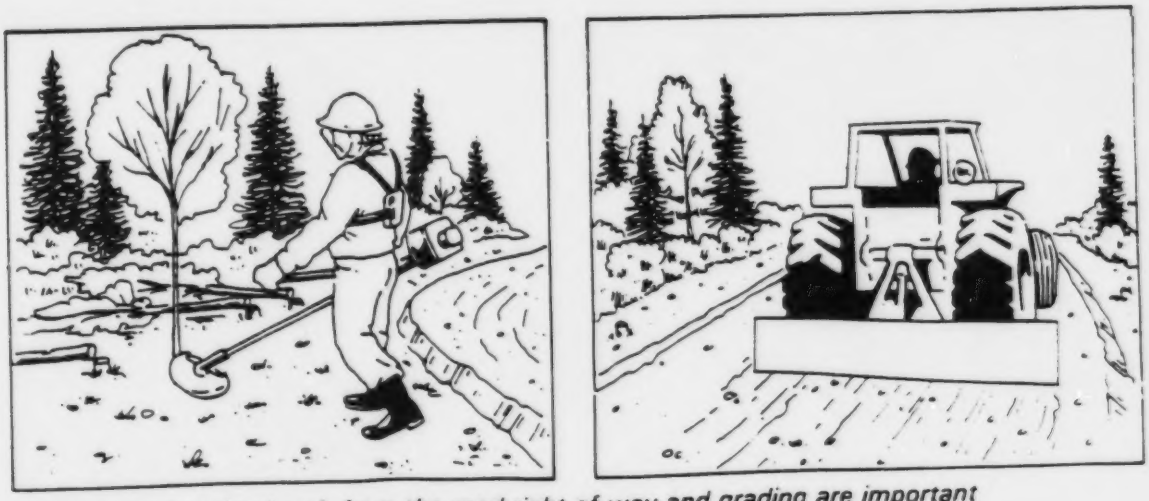


Figure 22. Clearing brush from the road right-of-way and grading are important considerations for maintaining woodlot roads in a usable condition.

4. Inspect culverts and bridges each spring and fall and remove debris or make repairs as needed. Branches, leaves, and other debris should not be allowed to accumulate in instream culverts to the point where fish passage is blocked or water flow is impeded. Major repairs, such as culvert or riprap replacement, may qualify for a Provisional, rather than a regular, Watercourse Alteration Permit as described in Section 2 of this manual.

5. If you must remove nuisance animals which are plugging your culvert(s), contact your local Department of Natural Resources and Energy office for assistance. It is an offence under the Fish and Wildlife Act for an unauthorized person to remove or damage a beaver house or dam.

6. Check stream crossing sites after the first heavy rain following installation to ensure that no erosion or stream siltation problems have developed.

7. Following logging operations, remove brush and other logging debris from the ditches and restore the road to its original condition.

8. Reduce the need for road maintenance by restricting access to your woodlot during the spring and excessively wet periods.

5.0 Temporary crossings

Temporary crossings are used where it is necessary to cross a stream but the construction of a permanent bridge or culvert is not feasible. Temporary crossings normally require a Watercourse Alteration Permit to install except for certain types of winter ice crossings which do not involve travelling directly on the stream bed or its banks, nor the removal of water from the stream to build up ice thickness. Temporary crossings must not be left in the water past the permit's expiry date.

The main types of temporary crossings structures are "portable" and "ice bridges".

5.1 Portable bridges

Portable bridges are not designed to withstand periods of peak water flow. They are meant to be used for a short period of time, such as during a harvest operation, and then to be removed.

A basic type used on small feeder streams is the portable pole bridge (Figure 23). It consists of 2 sill logs and 2 sections of 5 hardwood poles which are laid at a right angle across the sill logs. Sill logs are usually about 4 metres (13 ft) long and at least 25 cm (10 in) in diameter. Poles are 10 to 15 cm (5 to 6 in) in diameter and approximately 5 m (16.5 ft) long.

Poles are held in place by chains located about 1 metre (3.3 ft) from the pole ends. Chains are twisted around each pole and bolted together to keep them from slipping. This allows the portable bridge to be picked up and transported on the back of a trailer or forwarder to where it will be installed.

The bridge is assembled at the crossing site by positioning the sill logs parallel to one another on the stream banks. The pole sections are then laid across the sill logs at an appropriate distance apart to accommodate the track width of the machinery to use it.

Manufactured steel bridges are also available. Some are designed to be towed behind a half-ton while others are transported in pieces and assembled at the crossing site.

The installation of a portable bridge must have minimal impact on a watercourse.

1. Choose a site where the approaches are firm, have little slope, and there are no large stumps. The channel should be narrow and straight with the road or extraction trail crossing it at a right angle.

2. When clearing the right-of-way approach, keep its width to a minimum and avoid putting slash or any debris into the stream.

3. Place slash on the approaches before the crossing to prevent rutting and to stabilize the bridge when machinery is climbing up onto it. Add more slash as it becomes worn down.

4. Sill logs should be set on the bank and not in the watercourse.

5. Avoid entering the stream with machinery.

6. Generally, portable bridges are meant to be used by forwarders or a tractor and trailer combination. Trees or other forest products should not be skidded across portable bridges in such a way that they are dragged through a watercourse.

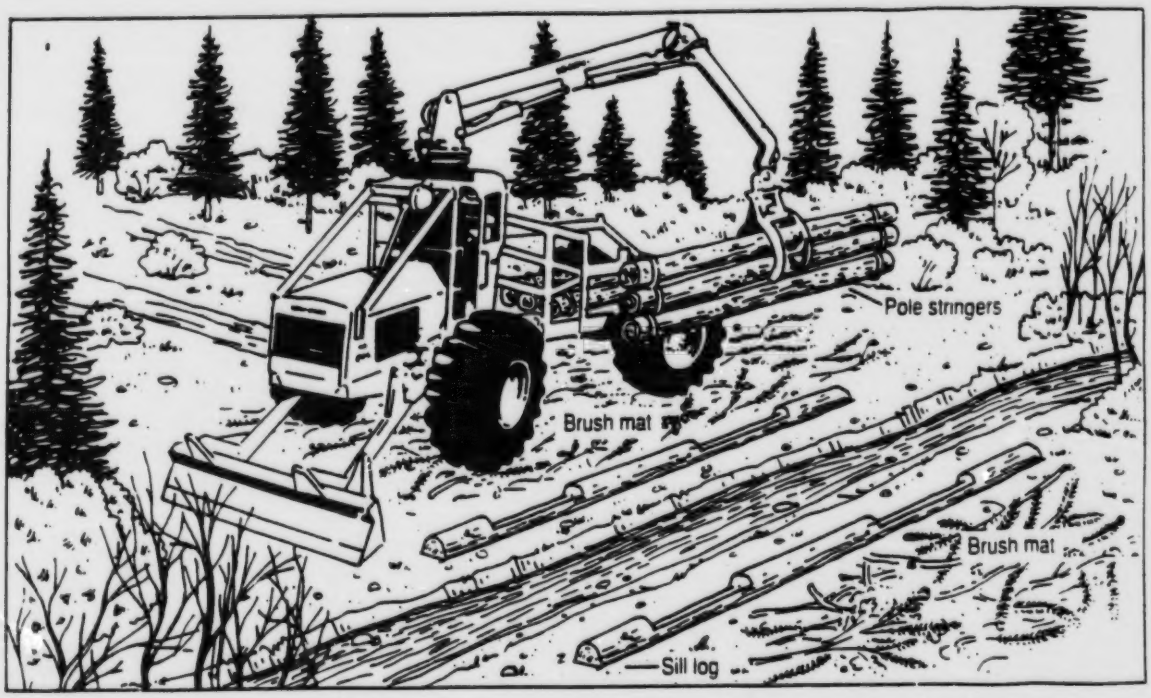


Figure 23. Installation of a portable pole bridge. Pole stringer sections are placed onto sill logs located on the stream bank.

7. Use the portable bridge during low stream flow and remove it completely once access is no longer needed. Repair wheel ruts and any other damage that may cause stream siltation and mulch exposed soil.

5.2 Ice bridges

An ice bridge is a temporary water crossing used to provide winter access to normally inaccessible areas (Figure 24). Ice bridges are constructed by pumping or spraying water in layers onto existing natural ice, to build up ice thickness until it can support the weight of machinery. Banks of snow or logs are used along the sides of the crossing to contain the water used to build up the ice layers. Logs are sometimes incorporated into the ice layers, usually parallel to the bridge or in a corduroy fashion, as a reinforcement to the ice.

Ice bridge construction which involves the removal of water from the watercourse to build up ice layers, or which incorporates logs into the bridge requires a Watercourse Alteration Permit.

Environmental guidelines for the construction of ice bridges include:

1. Choose a location where the banks of the watercourse have little or no slope to minimize the need for soil disturbance when preparing the approaches. Packing snow over the approaches will further help minimize bank disturbance. Approaches with minimal slope provide the best access and are less apt to cause machinery to lose power and roll backward during the crossing.

2. Avoid sites where water levels tend to fluctuate, spring seeps are present, or where the watercourse is narrow and fast-flowing. Fluctuating water levels may crack the ice, especially along the shoreline. Water warmed by springs does not readily freeze whereas strong currents tend to erode the underside of ice. Generally, slow-flowing pool sections make the safest crossing sites.

3. When clearing the right-of-way approach, keep its width to a minimum and avoid leaving slash or debris where it may enter the watercourse.

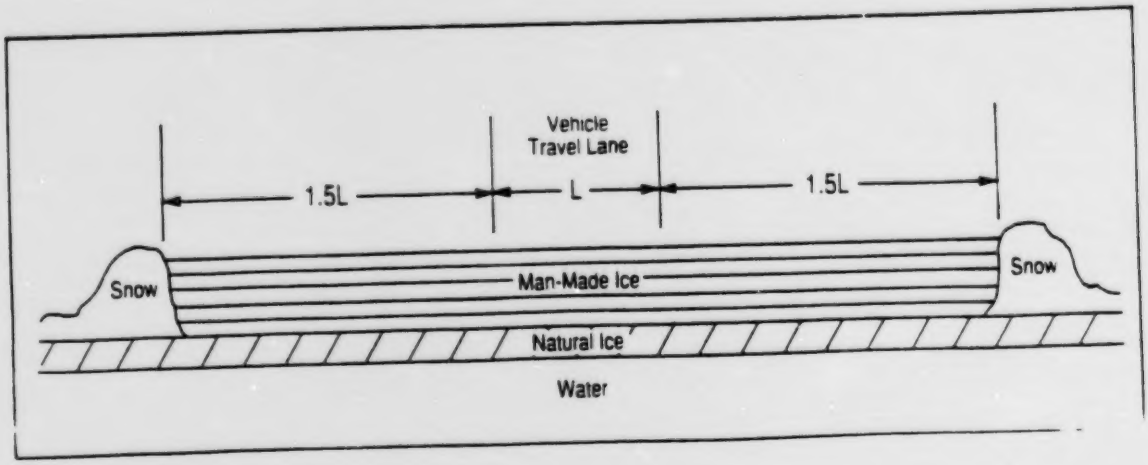


Figure 24. An ice bridge cross-section.

4. Ice thickness must be developed in a suitable manner to ensure the ice bridge is safe and capable of bearing the weight of vehicles which will use it. The usual practice is to begin with a shallow layer of ice about 2.5 cm (1.0 in) thick laid over the natural ice. Subsequent layers may be increased to 5.0 cm (2.0 in) in depth. Each layer must be given sufficient time to freeze before the next one is added.

If snow is present when flooding begins, it should either be removed or, if only a few centimetres are present, packed down and frozen. Snow banks are built up on each side of the ice bridge to trap water during the floodings. Snow beyond the banks, however, can be removed to promote thickening of the ice.

Ice bridge dimensions are dependent on the size of the watercourse being crossed and the width and weight of vehicles to use it. Generally, ice should be built up on each side of the vehicle travel lane a minimum distance of 1.5 times the travel lane width.

5. Ice thickness must be developed to suit the weight of traffic to use the crossing. The following ice thickness guide is used by the Spruce Falls Power and Paper Company of Ontario for clear blue lake ice. Reduce the bearing capacity by 15% for clear blue river ice and 50% for slush ice.

Permissable	Minimum Ice thickness (cm/in)
one person on foot	5.0 (2.0)
group in a single file	7.6 (3.0)
light truck (2.5 ton gross)	20.3 (8.0)
medium truck (3.5 to gross)	25.4 (10.0)
heavy truck (7-8 ton gross)	30.5 (12.0)
10 tons	38.1 (15.0)
25 tons	50.8 (20.0)
45 tons	63.5 (25.0)
70 tons	76.2 (30.0)
110 tons	91.4 (36.0)

6. If logs are used to reinforce an ice bridge, they must be removed before spring thaw to prevent them from entering the watercourse. Materials such as sand, brush, and wood chips should not be incorporated into the ice due to the difficulty in removing them once use of the ice bridge has ended.

7. Ice bridges should be checked carefully for signs of deterioration. Small surface cracks have little effect on load capacity but large deep cracks which pass through the ice sheet are dangerous. Heavy loads should not be permitted to cross or travel near them.

A reduction in ice thickness as determined by ice drillings, the approach of warmer spring weather, and the ponding of water on top of the ice should be considered as indicators to close the ice bridge for the season.

6.0 Extraction Trails

Extraction trails are the routes travelled by skidders, forwarders, and other equipment used to bring wood from the harvest area out to a landing. Although not as elaborate as a woodlot road, they involve disturbance of the forest floor and create significant potential for soil erosion and siltation of watercourses.

1. Extraction trails should follow natural contours and be located on dry ground away from poorly drained areas.

2. Soils easily cut by heavy equipment should be worked when frozen or dry. Reserve areas having well-drained soils and flatter slopes for wet weather harvesting.

3. On gentle terrain that slopes no more than 10%, skid or forward wood uphill where possible, so water running in the trail patterns is not concentrated at the landings.

4. On land that slopes more than 10%, avoid skidding straight downhill for long distances. Skid across slopes when safe to do so. Check your manufacturer's specifications to determine a recommended safe working range for your particular type of machine.

5. Fall trees so that limbs and tops end up on extraction trails unless working with an all terrain vehicle or horse. As the slash is run over by heavy equipment it will break up and pack into the soil, lessening soil disturbance.

Slash also keeps logs out of the mud during skidding, keeping them cleaner and reducing chainsaw wear during bucking. Softwood slash tends to more valuable in preventing soil erosion, especially on steep slopes, but hardwood slash is better than none.

6. Water bars should be installed across extraction trails when logging is complete. Water bars are small earthen ridges made diagonally across a road or trail surface by hand or with the blade of a skidder or forwarder. They divert runoff away from the extraction trail and minimize soil erosion and stream siltation by preventing the excessive build up of water flow on extraction trails (Figure 25).

Water bars are effective on extraction trails when:

(a) installed at a 30^0 angle to the trail;

(b) constructed so that they extend 30 cm (1 ft) above and 30 cm (1 ft) below the level of the trail surface;

(c) extended the entire way across the extraction trail so that all water is intercepted;

(d) outsloped 2 to 4% and made 2 to 3 metres (6 to 10 ft) in length;

(e) installed at a spacing relevant to the slope of the trail or road. A suggested spacing for water bars is:

Slope	Spacing m (ft)
< 5	38 (125)
5 to 10	30 (100)
10 to 20	23 (75)
20 to 30	15 (50)
>35	7.6 (25)

(f) installed after the logging operation is completed, beginning at the end of the extraction trail and working back towards the landing or woodlot road.

7. Seed and mulch exposed soil on extraction trails and landings once they are no longer in use. Refer to Appendix E for seeding guidelines. Apply hay mulch at a rate of at least one bale per 25 square metres (30 yd^2) and spread uniformly over the entire exposed area.

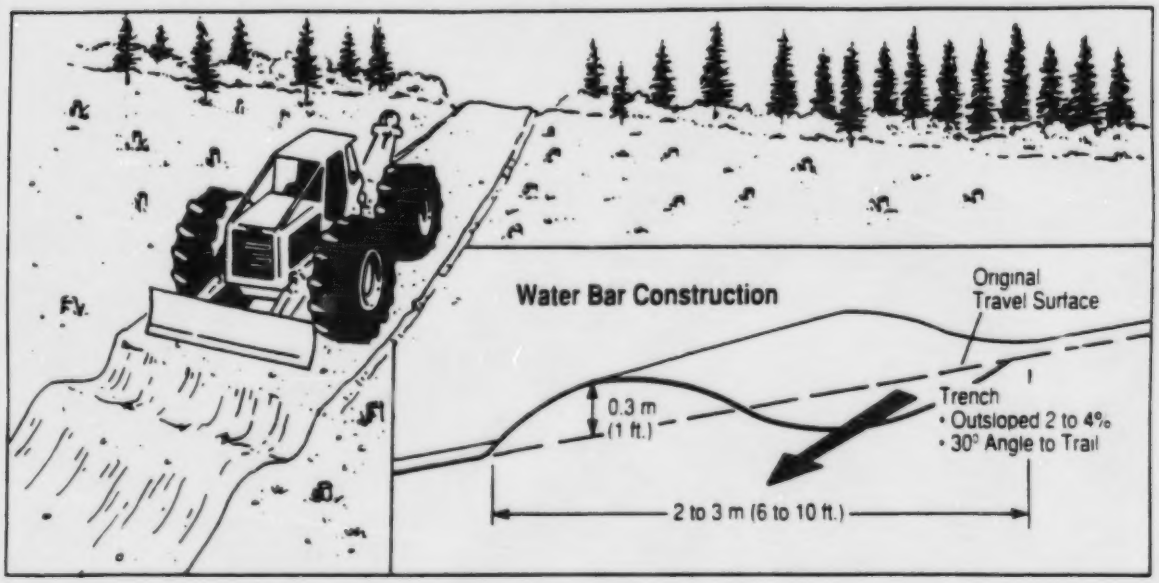


Figure 25. *Water bar construction. Water bars direct runoff away from skidding or forwarding trails and reduce soil erosion and stream siltation.*

7.0 Woodlot Ponds

7.1 Introduction

Properly constructed woodlot ponds add greatly to the beauty and value of a woodlot. They can also be used for fire protection, irrigation, erosion protection, pesticide application, fish production, and recreation.

The three basic types of woodlot ponds are embankment, dug-out, and bypass ponds (Figure 26).

1. **Embankment ponds** consist of a dam or embankment, usually earthen, built across a small valley or gully containing a spring seep.

Damming streams to construct embankment ponds has significant potential for environmental damage. Embankment ponds tend to silt in easily, block fish passage, and may washout.

Watercourse Alteration Permits are not normally issued for embankment ponds constructed by damming streams. For the purposes of this manual, the discussion of embankment pond construction is limited to ponds constructed by building embankments to trap water flow from springs or the headwaters of streams that do not support fish populations.

To determine whether or not a watercourse is capable of supporting fish, a representative from the Department of Natural Resources and Energy or the Department of Fisheries and Oceans should be contacted.

2. **Dug-out ponds** are made by digging a pit or "dug-out" in level to moderately sloped areas. Earth excavated to form the pond is usually piled or spread around the outside of the pond, but no dam is created. Dug-out ponds rely on surface runoff, groundwater, or a combination of both as their water source.

3. **Bypass ponds** are connected to a watercourse by inlet and outlet pipes.

7.2 Embankment ponds

7.2.1 Planning

1. **Embankment pond construction requires a Watercourse Alteration Permit** which should be applied for at least 8 weeks prior to the proposed construction period.

2. **If you plan on stocking your pond with fish you'll need an "Inland Aquaculture License"** from the Department of Fisheries and Aquaculture.

A "commercial class" aquaculture license permits the licensee to conduct aquaculture for commercial gain - such as to operate a "u-fish" operation or to sell fish for market. A "private" aquaculture license authorizes the licensee to carry on aquaculture for private use only. Aquaculture licenses must be renewed each year.

3. **Fish species that can be legally stocked in angling ponds, according to current New Brunswick fisheries regulations, are "indigenous" or native species such as brook trout, and Atlantic Salmon. Applications for other species may be considered.**

4. Other trout pond activities for which you need a permit are:

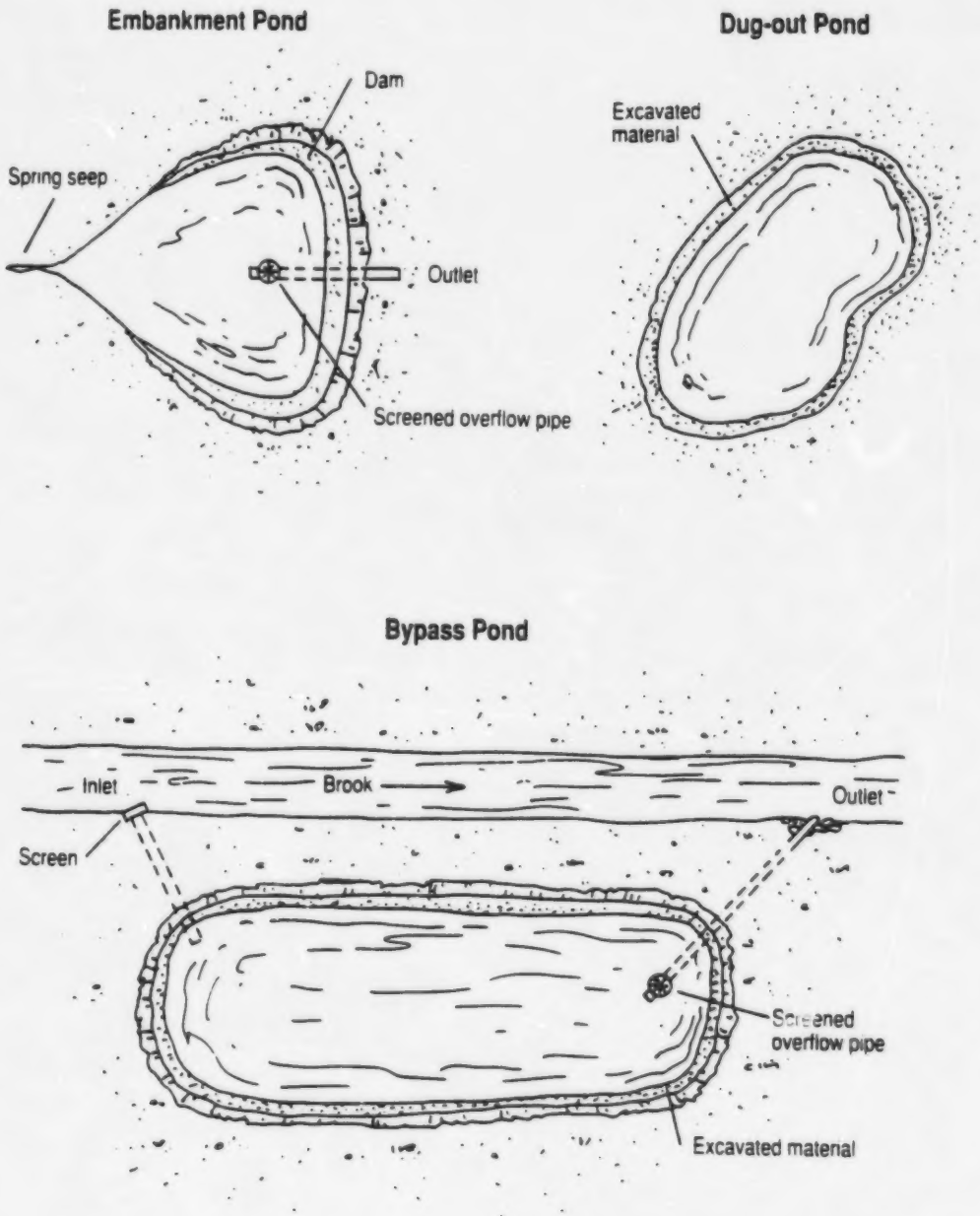


Figure 26. Embankment, dug-out, and bypass woodlot ponds.

Activity	Act
Importing fish/fish eggs into New Brunswick	Federal Fisheries Act of Canada
Sale of trout for human consumption	Fish Inspection Act
Liming or fertilizing a trout pond	Clean Environment Act
Chemical control of plants	Pesticide Control Act
Control of nuisance animals	Fish and Wildlife Act

The contact agency when stocking or constructing fish ponds is the Department of Fisheries and Aquaculture.

7.2.2 Location

1. Locate the embankment pond where it will receive an adequate water supply, such as a spring seep that flows year round. Do not allow the water surface of the pond to cover the spring, since overhead water pressure could reduce or redirect its water flow. Watercourse Alteration Permits are not normally approved for embankment ponds built by damming streams.

2. The pond should be located where the greatest volume of water can be stored by moving the least amount of fill. Two possible embankment pond locations are:

(a) narrow stream valleys or gullies with steep side slopes and a floor depressed enough to permit the storage of at least 2 metres (6 ft) of water flow;

(b) against the side or base of a hill where a crescent-shaped dam can be built to trap water flow.

3. Failure of the embankment must not result in damage to residential and commercial properties, to highways, railways, or utility lines.

4. Soil in the area where the water reservoir will be created should be impervious enough to prevent seepage. Soils with clay content are usually best.

Sites with sand or gravel soils should be avoided unless sealing measures are taken, since seepage in these soils tends to be excessive. Some limestone areas are especially dangerous; there may be crevices or channels in the limestone that can suddenly empty the pond.

5. The foundation under the dam must be able to support the embankment and provide the necessary resistance to water passage. Good foundation materials are rock or a mixture of coarse and fine-textured materials such as gravel-sand-clay soils. Poor foundations include soils with peat, muck, or organic matter.

6. Ponds nearest your home or woodlot cabin will receive the most use. If the pond is to serve as a water source in the event of fire, it should be accessible by road.

7. The construction of the pond must not influence water flow on other properties.

7.2.3 Design

1. **Dams must be planned and designed by a person licensed to practice as a professional engineer pursuant to the Engineering Profession Act who is familiar with hydrotechnical design.** Some exceptions to this requirement may be made, for example in cases where the site has a low storage capacity.

2. **Dams not capable of being safely overtopped must be designed to pass the maximum flood discharge unless a design engineer can demonstrate that a lesser spillway capacity is adequate without risking human life.**

Freeboard less than 1 metre (3 ft) :

$$q = 6.93\ A^{.34}$$

where

q = discharge rate in m^3/s (cfs)

a = catchment area in km^2 (mi^2)

Freeboard greater than 1 metre (3 ft) :

$$q = 3.465\ A^{.34}$$

where

q = discharge rate in m^3/s (cfs)

a = catchment area in km^2 (mi^2)

3. An embankment pond has four main parts:

(a) the embankment, or dam, which is built across the watercourse to back up a reservoir of water;

(b) the inlet or water source for the pond;

(c) the pond outlet, of which there are two basic types:

(i) earthen overflow channels, either natural or excavated;

(ii) mechanical spillways, constructed of plastic, metal pipes, or concrete. Wood is generally not considered suitable for spillway construction;

The function of the outlet is to pass water over, or around, the dam so that the water level in the pond does not rise enough to damage the dam by overtopping. The outlet must also be able to convey the water safely past the dam without damaging the downstream slope of the dam.

(d) The emergency spillway, which serves as an emergency overflow channel in the event the regular outlet can't handle flood flow.

4. Natural or excavated earthen channels are the simplest form of overflow channel, but not recommended for woodlot ponds due to their potential for washout, difficulty in water level control, and susceptibility to being dammed by beaver.

5. Mechanical spillways are of several designs and can be divided into two categories:

(a) "open spillways", such as concrete weirs, conduct water over the dam without the benefit of a pipe;

(b) "enclosed spillways" conduct water via a pipe through the dam.

The most basic type of enclosed spillway is a pipe inserted into the top of the dam through which overflow passes.

"Trickle tube" or overflow spillways are a more elaborate type of enclosed spillway. Although the type of pipe used to build such an outlet varies - corrugated metal, plastic, and metal casings are most commonly used — the basic design consists of a section of horizontal pipe connected to a vertical "overflow" pipe.

The horizontal pipe is located below the natural ground level and extends through the embankment from upstream to downstream sides. This pipe is called the "outflow pipe" and usually has a valve at the upstream end to permit draining of the pond.

Where outflow pipe sections are joined within the embankment, "anti-seep collars" of concrete are used to prevent seepage and erosion.

Anti-seep collars are located on the upstream side of the embankment about midway between the centre line of the fill and the vertical overflow pipe. They normally measure about 20 cm (8 in) thick by about 5 times the pipe diameter in height and width.

In the pond, the outflow pipe is connected to a vertical pipe known as the "trickle tube" or "overflow pipe". Usually built on a concrete base, this pipe is used to control the normal water level of the pond. A "trash rack" or "debris guard" and screen are positioned at its entrance to prevent plugging of the pipe and escape of stocked fish (Figure 27).

6. The diameter of the vertical pipe section must be somewhat larger than the diameter of the horizontal pipe, if the tube is to flow full. Generally, no pipes smaller than 15 cm (6 in) should be used for the outflow pipe.

7. The advantages of using a trickle tube or overflow outlet rather than a simple pipe outlet are:

(a) the pond's water level can be adjusted by adding or lowering sections of pipe as needed;

(b) complete removal of the overflow pipe from its base allows the pond to be completely drained;

(c) The outflow pipe is less susceptible to frost heaving.

8. Debris guards or trash racks are necessary to prevent the overflow pipe and its screen from becoming plugged by floating debris. The exact design varies with the type of overflow pipe.

Two types used with corrugated metal overflow pipes are the "conical" and "box" trash racks. Both designs consist of a series of steel rods welded to the intake end of the overflow pipe.

A debris guard design consisting of a hollow cylinder held in place by support collars is commonly used on plastic or metal casing overflow pipes.

9. **Screens shall have openings of not larger than 57 mm^2 (0.08 in^2).** This is equivalent to an opening of 7.5 mm by 7.5 mm (0.3 in by 0.3 in).

10. Emergency spillways should be built into the pond's embankment as a back-up system to the mechanical spillway in the event flood flow exceeds the capacity of the mechanical spillway.

Emergency spillways should:

(a) consist of a broad but shallow depression, normally measuring at least 1 metre (3.3 ft) wide by no more than 0.3 metres (1 ft) deep. If your pond is stocked with trout, you may wish to build the spillway wide and shallow as trout have less tendency to swim through shallow water;

(b) **be lined with non-erodible material,** such as rock;

(c) if lined with rock, **the material used should have a minimum dimension of 10 cm (4 in);**

(d) discharge onto a grassy or otherwise vegetated area.

11. Stage, the vertical distance between the top of the mechanical spillway and the bottom of the emergency spillway, should normally be no less than 0.3 metres (1 ft).

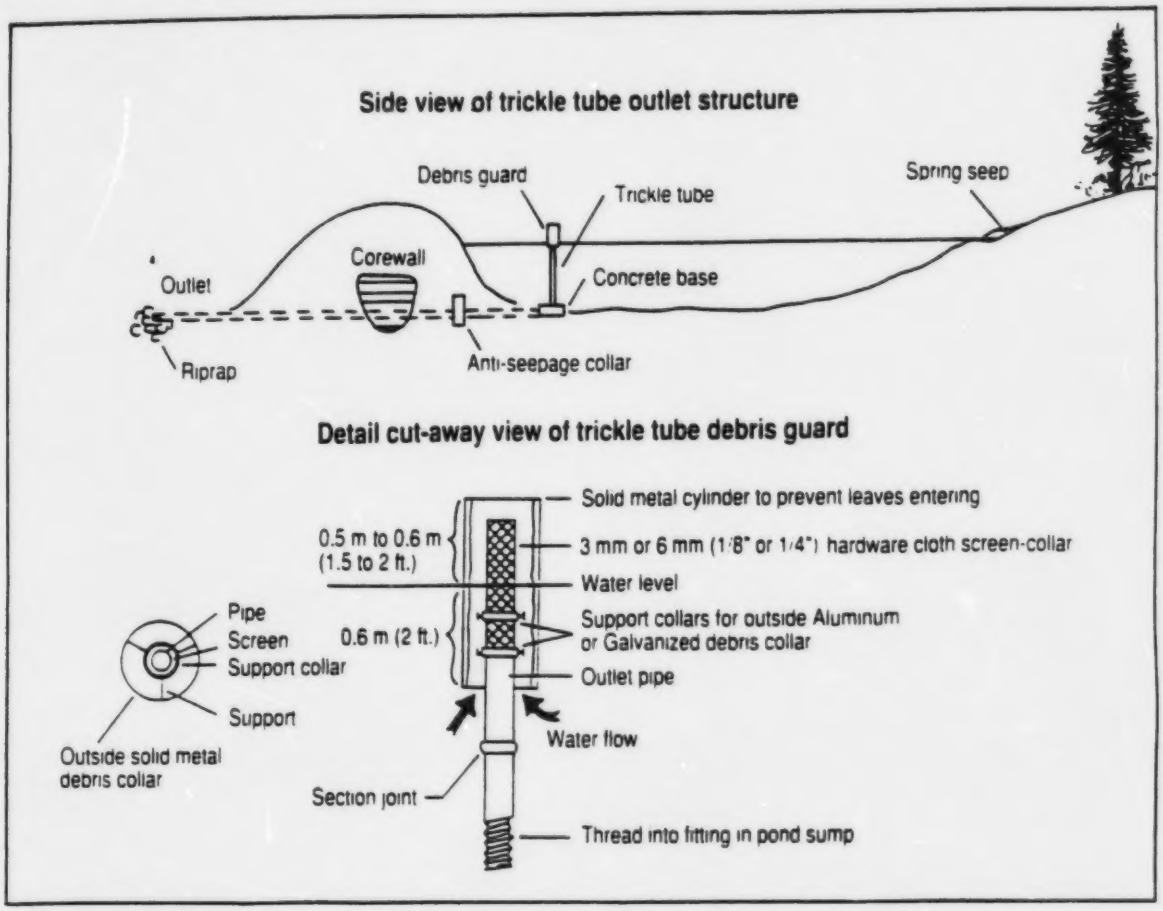


Figure 27. *Side and detail views of a trickle tube outlet.*

12. Freeboard, the vertical distance between the pond's normal water level and the top of the pond's embankment, should be a minimum of 0.5 metres (1.6 ft).

13. The pond should be large enough to meet its intended uses. Ponds used for family trout production, for example, are usually no smaller than 0.1 hectares (0.25 acres) in surface area and are a minimum of 2.5 metres (8.2 ft) deep over 25% of their surface area.

Here are the pond dimensions for a 0.1 hectare (0.25 acre) pond of the following shapes

Shape	Dimensions
Circle:	Diameter - 35.7 metres (117.1 ft)
Rectangle:	Length - 44.7 metres (146.7 ft) Width - 22.4 metres (73.5 ft)
Irregular elongate:	Length (long axis average) - 44.7 metres (146.7 ft) Width (short axis average) - 22.4 metres (73.5 ft)

Generally, the longer and more irregular the shape of a pond, the more productive it is for fish. Increasing the length and irregularity of a pond's shoreline usually increases the amount of emergent vegetation it will contain. Plants such as cattails and rushes, which flourish in the shallow water zone next to the shore, are a source of insect food for fish.

Maximum size for family trout ponds is 0.8 hectares (2 acres) in surface area and 6.0 metres (20 ft) in depth.

Deep ponds tend to be better for fish production since they hold more fish per surface acre of pond, have fewer weed problems, and tend to have a higher oxygen content.

14. Ponds built for purposes other than raising fish, such as for watering livestock or crop irrigation, have storage requirements specific to the type of animal or crop being grown. Some suggested storage capacities are:

Livestock -

Cattle - 2770 l (610 imp. gal)/month/animal
Hogs - 454 l (100 imp. gal)/month/animal
Sheep - 454 l (100 imp. gal)/month/animal
Poultry - 1816 l (400 imp. gal) /month/100 birds

Household - 6810 l/month/person (1500 imp.gal)

Fire protection - 454,000 l (100,000 imp. gal)

Irrigation - based on crop type 1 acre in = 102,650 (22,580 imp.gal)

A formula for determining pond storage capacity, based on the pond having side slopes of 2:1 and a flat bottom is:

v = 650 d a	v = 3.75 d A
v = pond volume (l)	v = pond volume (imp. gal)
d = max. water depth (m)	d = max. water depth (ft)
a = pond area (m^2)	a = pond area (ft^2)

Contact your local Department of Agriculture office for advice on appropriate pond dimensions if you intend to use your pond for agriculture related activities.

7.2.4 Construction

1. The area to be excavated for the pond basin must be cleared of all vegetation, slash, roots, sod, and loose topsoil before construction begins. **Trees and slash must also be removed from the area to be flooded and excavated.**

2. The pond's dimensions and outline of the base of the dam can be marked on the ground with wooden stakes before excavation begins.

3. A medium-sized bulldozer is well-suited for pond construction, but requires solid footing to work efficiently. Wet areas may require excavation by backhoe or excavator.

4. **Machinery and pollutants used during the pond's construction must not be located in areas in danger of floodwater.**

5. **Any debris and excavated material removed from areas adjacent to the watercourse must be disposed of, or placed in a manner, where it cannot be returned to the watercourse.**

6. Topsoil removed during the excavation can be stockpiled for landscaping after excavating is done.

7. During pond construction: **(1) a certain level of water flow, usually two-thirds of the original spring seep flow rate, must be maintained during the construction and filling of the reservoir, and (2) the excavation must be done in the dry.**

Measures for excavating the pond in the dry must be implemented before excavation begins. This involves use of one of the following techniques:

(a) building the new structure in the dry and diverting the water flow into it upon completion;

(b) constructing a temporary plastic lined diversion channel;

(c) stemming the flow upstream of the structure and pumping the flow around the site ensuring the pump runs at all times and the discharge is immediately downstream of the work area.

8. Building a "corewall", or cut-off ditch, where the embankment will be located reduces seepage and prevents water from flowing under the base of the dam.

A corewall consists of a trench dug lengthwise along the centre line of the dam extending up into the side slopes of the draw or gully which the dam is built across. The trench is backfilled with impervious material such as clay and well compacted in shallow layers, about 15 cm (6 in) thick.

Minimum depth of the corewall is 1 metre (3 ft) and deeper if necessary to reach the impervious material underlying the base of the dam.

The base of the corewall should be at least 1 metre (3 ft) wide with side slopes no steeper than 1:1.

9. Material removed from the excavation used to form the embankment around the pond site should not contain large rocks, vegetation, mud, frozen soil, or any foreign objects which water may seep around, or through.

10. Soil used to form the embankment should be added in 15 to 30 cm (6 to 12 in) layers, spread over the full width of the dam, and compacted with earth moving equipment. No more than 0.3 metres (1 ft) of soil should be added to the embankment at any one time. Soil should be damp to compact properly.

11. Add an extra 10% to the height of the embankment to allow for settlement which will occur even with soil compaction. It is not unusual for a pond embankment to settle 0.3 metres (1 ft) or more the first year after construction.

12. The top of the embankment should be no less than 2.0 metres (6.6 ft) wide. Greater width is needed if the embankment is to be used as a roadway.

13. **The combined slope of the upstream and downstream embankments should not be less than 5 horizontal to 1 vertical. Neither slope should be steeper than 2 horizontal to 1 vertical, except for the slope on the pond side which should be no flatter than 1 horizontal to 1 vertical, 0.5 metres (1.6 ft) down the slope from the normal water line.**

Generally, the slope on the downstream side of the embankment is at least 3:1 while that of the pond side is steeper - 2:1 and then 1:1. The shallower slope on the downstream side of the embankment gives it stability, while the steeper slope on the pond side reduces weed growth and makes the pond more accessible for fishing and less prone to winter oxygen depletion due to decomposing shoreline vegetation. This consideration is usually more important for dug-out than embankment or bypass ponds where there is water flow that tends to replenish water oxygen supplies. Sandy or loamy soils are prone to slumping and will require shallower slopes than clay soils.

14. Portions of slopes not submerged in water should be seeded or riprapped to prevent erosion by wave action. Where riprap is used, it should extend 0.3 metres

(1 ft) above to 1.0 metres (13.3 ft) below the normal water level line.

15. The pond bottom should be gently sloped towards the outlet end of the pond during excavation.

16. **Fill material around the spillway should be compacted to help prevent washout during high flows.**

Fill should be compacted in 15 cm (6 in) layers on each side of the outlet structure to minimize erosion and frost heave. Fill should not contain large rocks, sod, or vegetation to prevent the risk of washout. Wooden hand tampers for soil compaction can be made from a 15 cm by 15 cm (6 in by 6 in) piece of plywood or board attached to the end of a "two by four".

17. After the desired pond shape has been excavated, the pond bottom and sides should be sealed, especially in sandy and gravelly soils, to minimize water seepage. Sealing can be done by:

(a) compaction - the bottom layer of soil is compacted, such as by heavy machinery, so as to create a seal layer not less than 20 cm (8 in) thick where 3 metres (10 ft) or less of water is to be impounded. Increase the thickness of the seal proportionately where water depth is to be greater;

This is the cheapest method of pond sealing and should be considered a part of the construction process.

(b) clay blankets - the entire area over which water is to be impounded, including the embankment slopes, is blanketed with a layer of well graded coarse grained soil containing at least 20% clay. The clay blanket should be a minimum of 0.3 metres (1 ft) thick for depths of water up to 3 metres (10 ft). Increase this thickness by 5 cm (2 in) for each 0.3 metres (1 ft) of additional water depth;

(c) waterproof linings - flexible linings of polyethylene, vinyl, or butyl rubber can be used as a sealant. The top of the material is anchored into the pond by a trench excavated around the pond site and is covered by a shallow protective layer of fill not less than 15 cm (6 in) thick.

Linings vary in terms of cost, ease of application, and their ability to resist damage. Seek professional advice before purchasing sealants for use in woodlot ponds.

18. Place riprap around the outlet structure, especially if it is a pipe outlet, for erosion protection. Ideally, discharge from the outlet should drop into a stilling pool protected by rock.

19. **Any exposed material resulting from cut and fill operations must be stabilized against erosion** as soon as possible to prevent siltation.

Soil stabilization can be done by seeding with grass and/or mulching exposed soil. Refer to Appendix E for seeding guidelines. Apply hay mulch at a rate of at least one bale per 25 square metres (30 yd^2) and spread uniformly over the entire exposed area.

7.2.5 Maintenance

1. Inspect the pond regularly, especially after heavy rains, to see that leaks have not developed or the outlet structure has not become clogged. Embankment or spillway erosion should be filled, compacted, seeded, and/or mulched. Screens and trash racks should be cleaned of debris as needed, but especially during the fall and spring periods when there tends to be more floating debris.

2. **Any debris or sediment taken from the outlet structure must not be allowed to enter the adjoining watercourse.**

3. Where weeds become a problem, they can be removed by pulling them out by hand. Use of chemical herbicides is discouraged in trout ponds due to the risk to fish and other aquatic plant life, and is subject to approval by the New Brunswick Pesticide Advisory Board. Consult a fisheries biologist before attempting any chemical weed control.

4. Adding lime or fertilizer products to trout ponds to improve the water's acidity and fertility for fish production should only be undertaken with the advice of a fisheries biologist.

5. Avoid allowing farm animals, such as cattle, direct access to the pond since they destroy pond banks and cause siltation. A more suitable alternative is to pipe the water from the pond to a water tank.

7.3 Dug-out ponds

Dug-out pond construction has less potential for environmental damage than other types of pond construction, since dug-out ponds rely on surface runoff and ground water sources, rather than watercourses, for their water supply. Dug-out pond construction should take into consideration the following items:

1. **Dug-out ponds do not require a Watercourse Alteration Permit unless they are being built within 30 metres (100 ft) of a watercourse.**

2. The minimum distance from the pond to a watercourse should be 15 metres (50 ft) as measured from the top of the bank to the top of the bank.

3. Dug-out ponds which rely solely on surface runoff as their water source should:

(a) have a drainage area of 2.0 to 6.0 hectares (5 to 15 acres) for each 0.4 ha (1 acre) of pond area in order to provide adequate drainage;

(b) not receive crop or livestock drainage, which are sources of pollutants such as fertilizers, pesticides, and silt. Approximately one-half to three-quarters of the drainage area should be woodland;

(c) not be relied upon to support the same number of fish as stream, spring, or ground water-fed ponds of similar size. Dug-out ponds dependent solely on surface runoff are subject to frequent water level and temperature fluctuations and have a lower carrying capacity for fish populations than spring or ground water fed ponds.

4. An "Inland Aquaculture License" must be obtained from the Department of fisheries and Aquaculture before stocking a dug-out pond with fish.

5. **The average depth of the dugout pond should not be less than 1 metre (3.3 ft).** Adequate depth is important to keep evaporation and seepage losses low and to prevent stagnation.

6. The side slopes of the pond should be no steeper than two horizontal to one vertical to a depth of 1 metre (3.3 ft) below the water line. Below this elevation, the slope should be no flatter than 1 horizontal to 1 vertical. This is to prevent the excessive growth of unwanted vegetation on the sides of the pond.

7. No water shall be withdrawn from a watercourse to supply a dug-out pond.

8. The pond should be fenced to control access by livestock and people.

7.4 Bypass ponds

Bypass ponds are distinguished from other pond types by the fact they are connected to their water source - an adjacent stream, by inlet and outlet structures. Guidelines pertaining to bypass pond construction are in many ways similar to those of embankment pond construction. These include:

7.4.1 Planning

1. **Bypass pond construction requires a Watercourse Alteration Permit** regardless of how far the pond is from the adjacent watercourse, since the pond is connected to it by an inlet and outlet. Applications should be made at least 8 weeks prior to the proposed construction period.

2. **If you plan on stocking your bypass pond with fish, you'll need an "Inland Aquaculture License"** from the Department of Fisheries and Aquaculture.

3. Do not attempt to build your bypass pond without engineering assistance. Your local Forest Extension representative can direct you to someone in your area who has pond construction experience.

7.4.2 Location

1. Ideal topography for bypass ponds is a natural low area surrounded by gentle to rolling terrain with abundant forest cover. Where possible, the water supply should be augmented by ground water springs or surface runoff to decrease demands from the watercourse.

2. **Bypass ponds should be located a minimum of 15 metres (50 ft) from the nearest watercourse, as measured from the top of the bank of the pond to the top of the bank of the watercourse.**

The bank of the pond is considered to be the point where there is a break in the pond's embankment which marks its highest point of elevation. The watercourse bank is that point where there is a break in the slope of a shoreline created by the action of surface water and is characterized by a lack of, or change, in vegetation type.

3. The pond should not be located in an area subject to flooding, such as an island or a flood plain adjacent to a river.

4. **The area draining into the pond should not include known sources of pollution** such as barnyards, feed lots, septic tanks, etc. Excessive algae blooms and siltation from such areas are especially detrimental to trout production.

5. If the pond is to serve as a water source in the event of fire, it should be accessible by road.

Generally, ponds built near the landowner's house or woodlot cabin are easiest to properly manage and use.

6. **The pond should be excavated in an area having a non-porous subsoil,** such as clay, **or sealed** to prevent water seepage.

Soil type can be tested with a soil auger or post hole digger. Clay content can usually be detected by squeezing a handful of fairly moist soil into a firm ball. If it doesn't crumble with a little handling, the soil usually contains enough clay to be non-porous.

Gravelly or sandy sites should be avoided unless you have no alternative locations. In such cases, sealing measures are likely required.

7.4.3 Design

1. A bypass pond has three main parts:

(a) the inlet and outlet structures, which divert water from, and back into, the adjacent stream;

(b) the emergency spillway, which serves as an emergency overflow during periods of flooding;

(c) the embankment, or berm, which surrounds part, or all, of the pond and is made from fill removed during excavation of the pond.

2. **Inlet and outlet structures should consist of a section of conduit,** such as pipe, **which has a closed perimeter.** Ditches or trenches are not acceptable means of connecting the pond to the watercourse, because they are a source of sediment and difficult to screen.

Generally, trickle tube and overflow type outlets are preferred over simple pipes because they are less prone to frost heave, allow better control of the pond's water level, and permit draining of the pond.

3. **The inlet and outlet of the pond must be screened at their upstream ends. For fish ponds, both ends of the inlet and outlet pipes must be screened.**

Screening prevents the movement of fish between the pond and the stream, which reduces competition and the spread of disease between wild and stocked fish.

It should be noted that the upstream end of the inlet structure is located at the brook, whereas the upstream end for the outlet structure is in the pond.

4. **Screens shall have openings not larger than 57 mm² (0.08 in²).** This is equivalent to an opening of 7.5 mm by 7.5 mm (0.3 in by 0.3 in).

5. **The maximum water withdrawal rate per pond from the watercourse must not exceed: (1) one-third of the low flow rate for the site as computed by the formula:**

$q = 0.00055\ m^3/s/km^2 . A\ km^2$
$q = 0.05\ cfs/mi^2 \cdot A\ mi^2$, where

q = the low flow rate of the watercourse
a = the catchment area, or

(2) an approved "maintenance rate".

7.4.4 Construction

1. **The site should be cleared of all vegetation, slash, roots, sod, and loose topsoil. Spoil material should be disposed of where it cannot be returned to the watercourse by storm runoff.**

2. Minimize siltation of the adjacent watercourse during pond excavation by

(a) **excavating the pond prior to installing the inlet pipe(s).**

(b) **implementing erosion control measures,** such as riprapping and seeding or mulching, **as construction proceeds, rather than waiting for its completion.**

(c) diverting runoff away from the pond site into a vegetated filter area by digging a temporary diversion ditch or ridge of soil on the uphill side of the excavation site.

(d) not releasing pond water through the outlet and into the adjacent stream until silt has settled out. Normally this is done by plugging the outlet allowing the pond to fill up once the inlet has been installed. Once the pond is full of water, the inlet is also plugged to prevent the backflow of silty water into the adjacent stream. After the pond water has been allowed to clear, the

outlet and then the inlet can be opened (Figure 28).

3. **The side slopes of the pond should be no steeper than 2 horizontal to 1 vertical to a depth of 0.5 metres (1.6 ft) below the water line. Below this elevation, the slope should be no flatter than 1 horizontal to 1 vertical.** This is to prevent the excessive growth of unwanted vegetation on the sides of the pond.

4. **Place riprap around both ends of the inlet and outlet pipes for erosion protection.**

At the inlet, riprap should extend a minimum of 0.75 metres (2.5 ft) or 1 pipe diameter, whichever is greater, on each side of the pipe. The outlet should be riprapped similarly, except that it should extend past the front of the pipe a minimum of 5 pipe diameters and be 3 diameters in width.

5. **Place riprap on the outside of the berm of the pond where it borders the watercourse** if the pond is at risk from flooding.

6. Extend riprap used to stabilize the shoreline from wave action 0.3 metres (1 ft) above to 1.0 metres (3.3 ft) below the normal water level line.

7. Where there is a risk of injury to people or livestock, fence the pond to control their access. Fencing reduces damage and pollution by livestock and provides the protection needed to develop and maintain plant cover along the banks of the pond.

Fencing and posting of a pond may also reduce your liability in the event someone is injured while using your pond. Contact your insurance agent for more information.

7.4.5 Maintenance

1. Inspect the pond frequently to see that leaks have not developed or the outflow pipe has not become plugged. Inlet and outlet screens should be cleaned at regular intervals, especially during the fall and spring periods.

2. **Any debris or sediments taken from the inlet or outlet areas must not be allowed to enter the adjoining watercourse.**

3. If water from a bypass pond is to be discharged over a short period of time, for irrigation purposes, for example, the inlet should be closed during the discharge. When the inlet is reopened, it should be done gradually to prevent rapid depletion of flow in the watercourse and allow gradual refilling of the pond.

4. Where weeds become a problem, they can be removed manually by pulling them out by hand, or chemically, with herbicides. Use of chemical herbicides is discouraged in trout ponds due to the risk to fish and other aquatic plant life. Consult a fisheries biologist before attempting any chemical weed control.

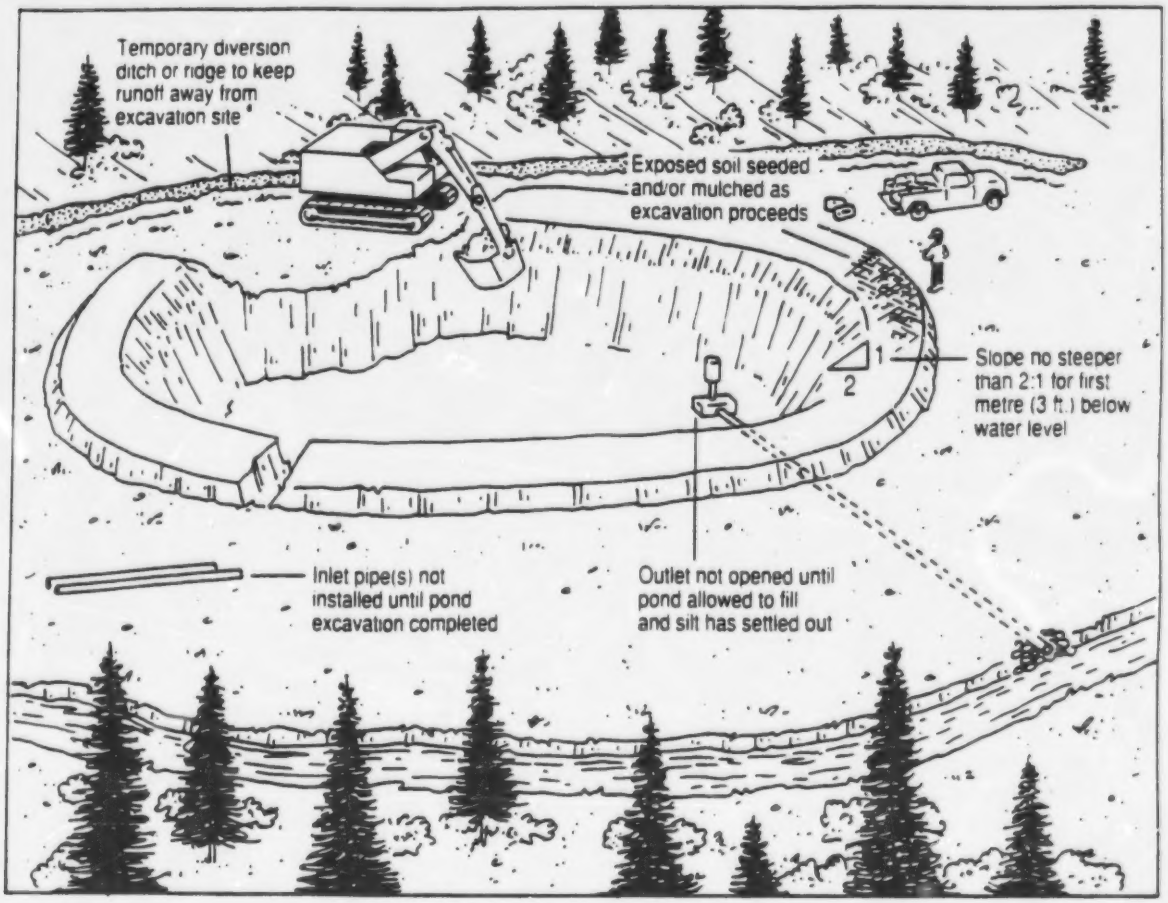

Temporary diversion ditch or ridge to keep runoff away from excavation site
Exposed soil seeded and/or mulched as excavation proceeds
1
2
Slope no steeper than 2:1 for first metre (3 ft.) below water level
Inlet pipe(s) not installed until pond excavation completed
Outlet not opened until pond allowed to fill and silt has settled out

Figure 28. Siltation control measures for bypass pond construction.

Section 2

Environmental Guidelines and Provisional Permits

8.0 Introduction

The Department of Environment has determined that a number of activities that take place in, or adjacent to, watercourses will not significantly affect the environment if carried out in accordance with prescribed conditions. These activities qualify for a special type of Watercourse Alteration Permit known as a Provisional Permit. These permits apply to the following activity categories:

1. riprap;

2. adding to, or replacing, an existing culvert or single span bridge;

3. soil disturbance adjacent to a watercourse;

4. intake pipes and instrument pools or wells;

5. maintenance and stabilization of existing structures;

6. debris removal;

7. road construction adjacent to a watercourse;

8. replacement of undesirable vegetation;

9. bush cutting adjacent to a watercourse;

10. Storm sewer outfall pipes;

11. Selective timber harvesting within 30 metres (100 ft) of a watercourse.

9.0 Application Information

The following conditions apply when making an application for a Provisional Permit.

1. If your activity is located within one of the protected areas, as specified in the Watercourse Setback Designation under section 14(1) of the Clean Water Act (i.e., watercourses used as municipal potable surface water supplies), you do not qualify for a Provisional Permit.

2. If your project meets the applicability test, then review the "Conditions" section for the specific requirements you must meet. Reading the "Purpose" section will help you get a general understanding of why each appropriate condition must be met.

3. All questions about specific conditions or your projects' ability to proceed under these rules should be directed to the Watercourse Alteration Program staff. Staff are available weekdays to answer your questions.

4. If you meet all applicable conditions, you do not have to file an "Application for a Watercourse Alteration Permit". Before beginning the work, however, you must file notice of the proposed project on a notification form provided by the Department of Environment. This form includes one duplicate copy, which you are to keep. The original is to be sent to the Department of Environment. The permit satisfies the requirements of the Watercourse Alteration Regulation under the Clean Water Act and is effective for two years, provided all standards are complied with and all work, including stabilization measures, is carried out between June 1st and September 30th of the same year.

5. Nothing in this section prohibits the filing of an "Application for a Watercourse Alteration Permit" to perform activities not allowed by Provisional Permit.

6. Projects that do not meet all the conditions do not qualify for a Provisional Permit and require the filing of an "Application for a Watercourse Alteration Permit".

7. Projects which qualify for a Provisional Permit must still meet all other applicable municipal, provincial, and federal requirements, rules and regulations.

8. It is understood that a Provisional Permit does not exempt the proponent from the provisions of any act of the Legislature of New Brunswick, or Parliament, or any due process of law, or serve to deprive any person of his or her rights either under statue or common law to claim damages or loss or injury caused to their property by reason of the watercourse alteration.

9. Issuance of a Provisional Permit places no liability upon the Minister of the Department of Environment.

10. You will receive an acknowledgement, a list of conditions by which the alteration must be carried out, and a receipt for the required fee. Upon receiving this documentation, which should be kept at the site as evidence that your notification form was received by the Department of Environment, you may proceed with your proposal.

10.0 Riprap

10.1 Applicability

1. This rule allows the placement of riprap in order to control erosion along the shoreline of a watercourse. This rule limits riprap to that required to control sediment, protect an eroding bank or conserve agricultural land, where the erosion cannot be controlled by vegetation (Figure 29).

2. This rule does not apply to the placement of riprap along an eroding bank for a distance greater than 60 metres (200 ft).

10.2 Purpose

These standards were prepared to ensure that riprap is placed in a manner that will not cause siltation of the water nor disturbance of aquatic habitat and will result in stable construction able to withstand the forces of waves and ice.

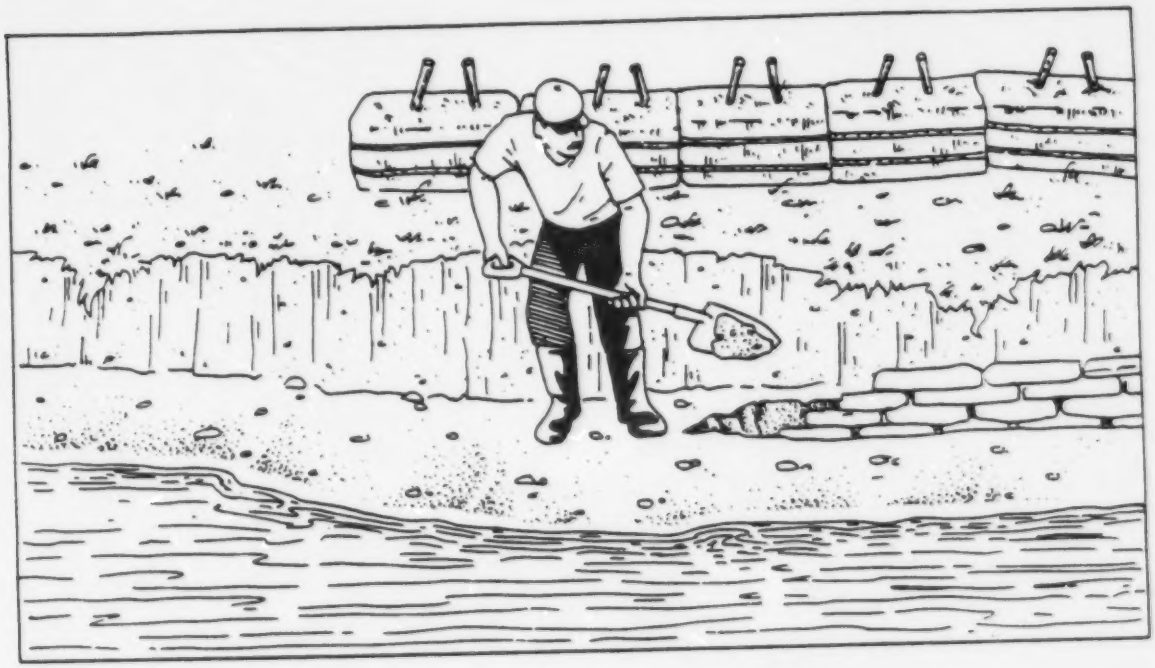


Figure 29. The "riprap" activity category applies to the use of riprap to control erosion along the shoreline of a watercourse.

10.3 Conditions

1. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent, and submitted to the Department along with the notification documents.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. Riprap shall only be used on portions of the banks of a watercourse where erosion is occurring and cannot be effectively controlled by vegetation.

4. Rocks used for riprap must have an irregular shape and be no smaller than 15 cm (6.0 in).

5. Rocks used for riprap must not be obtained from the bed or banks of the watercourse, because they help prevent erosion and provide habitat for aquatic life.

6. Riprap shall extend no further than 60 metres (200 feet) along the shoreline of any watercourse, except when being used to replace the entire length of an existing retaining wall if stabilization with vegetation is not an option.

7. Riprap must not extend any higher on the bank than the level at which vegetation can be established to control erosion. Trees, shrubs and grass must be planted above the high water line to replace any vegetation that was removed.

8. The slope of the riprap must not be steeper than 1.5 horizontal to 1 vertical.

9. Riprap must be anchored at the base of the existing bank or replaced retaining wall by placing the bottom row of rock in a trench excavated to a depth at least equal to the height of the largest rock.

10. Riprap must not be placed in front of a retaining wall so that it extends further into the water.

Note: Placement of riprap into the water must be minimized as much as possible and must not result in extending the property to the area below normal high water mark.

11. A layer of filter fabric and/or a layer of coarse gravel between 10 - 30 cm (4 to 12 in) thick must be placed under the riprap to prevent underlying soil particles from washing into the water.

12. No fill other than the riprap and gravel may extend below the normal high water line.

13. A buffer strip of undisturbed vegetation at least 6 metres (20 ft) wide must be established and maintained along the upland edge of any riprap placed for the protection of agricultural land.

Note: On flowing watercourses, the use of riprap should be minimized by planting shrubs or bushes wherever possible to provide bank stabilization, shading for the water, and cover for wildlife.

14. Prior to the start of the activity, hay bales and/or filter fabric must be installed along the perimeter of the area to be altered to ensure that soil material does not enter the watercourse.

15. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

16. Disturbed soil must be immediately stabilized if the area is not to be actively worked for more than one week using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

17. Hay mulch, where used, must be applied at a rate of at least one bale per 25 metres^2 (30 yds^2) or 1 kg per metre^2 (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

18. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

19. In addition to the placement of riprap, sod, erosion control blankets or hay mulch, additional steps must be taken where necessary to prevent water sedimentation. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place before starting any work, and shall be installed wherever necessary due to sedimentation.

20. When work is carried out in flowing watercourses less than 1 metre (3.3 ft) deep at the time and location of the work, the flow must be temporarily diverted to the opposite side of the channel while the work is in progress. Water diversion guidelines include:

(a) sandwich 6 mil plastic sheeting between an inner wall of in situ earth material and an outer wall of either rocks, sandbags or a steel H-beam attached to the bottom of a 2.5 cm (1 in) thick sheet of plywood;

(b) all water pumped from inside the cofferdam must be discharged over an area of natural vegetation to filter out the suspended solids before it re-enters the watercourse or into a settling pond such that the level of suspended solids in the watercourse does not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken 50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site;

(c) all material used to temporarily divert flow must be completely removed upon completion of the project, and the watercourse substrate restored to its original condition; and

(d) the inner wall of in situ earth material must be completely removed, prior to the removal of the remainder of the cofferdam.

21. No self-propelled wheeled or tracked heavy equipment shall be operated in the wetted portion of the watercourse except as follows:

(a) equipment may cross the watercourse on a rock, gravel or ledge bottom while carrying out the project;

(b) equipment stationed on shore may, where necessary, reach into the wetted portion of the watercourse with a bucket or similar extension;

(c) pumps may be operated, where necessary, for temporary diversions; and

(d) this restriction does not apply to boats and floating barges.

22. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water level or low flow.

23. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must conform with the Water Quality Regulation under the Clean Environment Act, which is administered by the Department of Environment.

24. Riprap must be clean, inorganic, non-ore-bearing, non-toxic material obtained from a non-watercourse source.

25. The minimum thickness of the riprap must be 1.5 times the maximum stone size.

26. The riprap must be placed to its full thickness as the project proceeds.

11.0 Adding to or replacing an existing culvert or single span bridge

11.1 Applicability

1. This rule allows for replacing, extending or adding a structure to an existing crossing using one or any combination of the following:

(a) a single span bridge;

(b) a single or multiple, round, arched or box culvert less than 25 metres (82 ft) long, if the gradient of the bed of the watercourse does not exceed 0.5 percent (Figure 30).

2. The addition of a climbing lane of which less than 300 metres (984 ft) of its length is within 30 metres (100 ft) of a watercourse.

11.2 Purpose

These are designed to ensure that the replacement, addition or extension of a road crossing structure will not:

1. interfere with any existing navigational uses;

2. cause the erosion of soil or siltation of the water;

3. interfere with the normal flow of water;

4. interfere with fish migration or spawning.

11.3 Conditions

1. When work is carried out in flowing watercourses less than1 metre (3.3 ft) deep at the time and location of the work, the flow must be temporarily diverted to the opposite side of the channel while the work is in progress. Water diversion guidelines include:

(a) sandwich 6 mil plastic sheeting between an inner wall of in situ earth material and an outer wall of either rocks, sandbags or a steel H-beam attached to the bottom of a 2.5 cm (1 in) thick sheet of plywood;

(b) all water pumped from inside the cofferdam must be discharged over an area of natural vegetation to filter out the suspended solids before it re-enters the watercourse or into a settling pond, such that the level of suspended solids in the watercourse does not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken 50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site;

(c) all material used to temporarily divert flow must be completely removed upon completion of the project and the watercourse substrate restored to its original condition; and

(d) the inner wall of in situ earth material must be completely removed prior to the removal of the remainder of the cofferdam.

2. If a perennial watercourse at the point of crossing is used for navigation, the crossing must consist of a bridge span or pipe arch with at least 1.2 metres (4 ft) of clearance during normal high water for boat traffic.

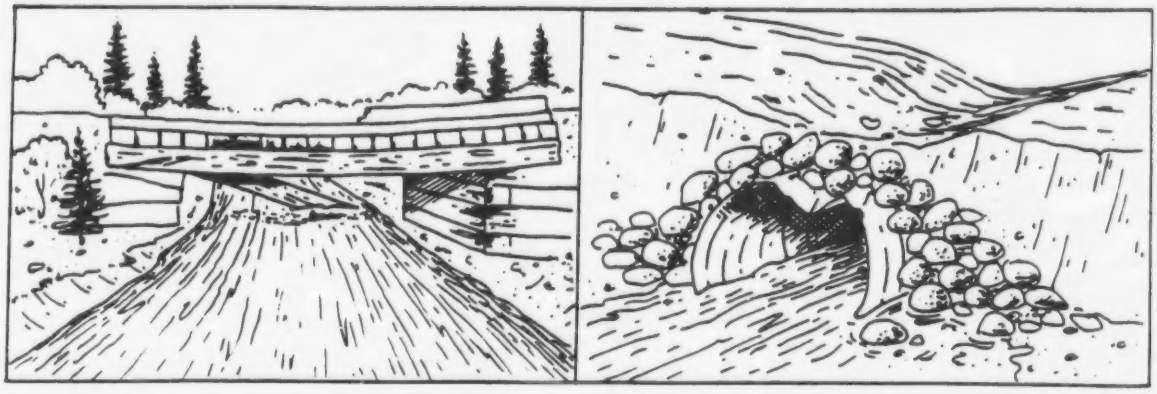


Figure 30. Single span bridges and culverts less than 25 metres (82 ft) in length may be replaced under the "adding to or replacing an existing culvert or single span bridge" activity category.

3. If the gradient of a perennial watercourse at the point of crossing exceeds 2%, the crossing must consist of a structure which will maintain the natural streambed, such as a bridge span or arch on concrete footings.

4. Fill sideslopes within 30 metres (100 ft) of the watercourse must be maintained at a slope no steeper than 1.5 horizontal to 1 vertical.

5. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Water Quality Regulation under the Clean Environment Act which is administered by the Department of Environment.

6. Bridges, culverts and multiple structures must be installed and maintained to provide a waterway opening area at least equal to the cross-sectional area of the channel or of sufficient area to accommodate the high flow for a 100 year recurrence interval as determined by the Department of Environment, whichever is greater.

7. Culverts and bridges may be smaller than required in condition 6, if techniques, such as removing culverts prior to October 1st of the year in which they were installed, are employed that maintain the natural course of water flow and prevent sedimentation in the event of flooding.

8. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

9. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

10. Disturbed soil must be immediately stabilized if the area is not to be actively worked for more than one week using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

11. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yds^2) or 1 kg per $metre^2$ (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

12. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

13. In addition to the placement of riprap, sod, erosion control blankets, or hay mulch, additional steps must be taken where necessary to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

14. No self-propelled wheeled or tracked heavy equipment shall be operated in the wetted portion of the watercourse except as follows:

(a) equipment may cross the watercourse on a rock, gravel or ledge bottom while carrying out the project;

(b) equipment stationed on shore may, where necessary, reach into the wetted portion of the watercourse with a bucket or similar extension;

(c) pumps may be operated, where necessary, for temporary diversions; and

(d) this restriction does not apply to boats and floating barges.

15. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water level or low flow.

16. Surface water on, or adjacent to, crossing approaches must be diverted through a vegetative filter area at least 30 metres (100 ft) wide to help prevent sedimentation of the watercourse. Roadside ditches must not extend to the watercourse being crossed.

17. Culverts where used shall:

(a) not exceed 25 metres (82 ft) in length and must be the shortest length possible to accomplish the purpose for the crossing;

(b) extend a minimum of 0.3 metres (1 ft) beyond the upstream and downstream toe of the fill placed around the structure;

(c) (i) have the fill placed around the structure retained by squared timber or rock-filled wire basket headwall with the slope of the material above the headwall being no steeper than 2 horizontal to 1 vertical; or

(ii) be covered with unretained fill placed at a maximum slope of 2 horizontal to 1 vertical, and stabilized with riprap from the toe of the embankment to an elevation of at least one-half the diameter or height of the culvert above the top of the structure, and a minimum of one pipe diameter on each side of the structure immediately upon completion of the culvert installation;

(d) have the soil compacted at least halfway up the sides of the culvert;

(e) follow the alignment and grade of the watercourse as much as possible. On perennial watercourses the gradient of the culvert must not exceed 0.5 percent;

(f) the invert of the outlet end of the culvert must be installed at least 15 cm (6 in) below streambed elevation, except when there is more than one culvert at the same crossing;

(g) where two or more culverts are installed at one crossing, they must be offset in order to concentrate low flows into the culvert within the natural low flow channel;

(h) be covered to a minimum depth of one-half the diameter or height of the culvert; and

(i) be seated on firm ground, or on geotextiles, logs or other material used to stabilize the bed material.

18. Wood treated with creosote or pentachlorophenol must not be used below the normal high water line.

19. Lumber pressure-treated with materials such as chromated copper arsenate must be cured on dry land such that all surfaces are exposed to the air for a period of at least 21 days prior to construction.

Note: Spacing lumber with small strapping is an acceptable method of exposing the surfaces.

20. Prior to the start of the activity, hay bales and/or filter fabric must be installed around the perimeter of the area to be altered to ensure that soil material does not enter the watercourse.

21. None of the material used to build the approaches to the structure is to be obtained within 30 metres (100 ft) of the watercourse.

22. The bridge must be constructed with squared tamarack, hemlock or some other type of long lasting wood.

23. In order to prevent surface water which may carry sediment from exposed soil from directly entering a watercourse:

(a) a strip of undisturbed vegetation at least 30 metres (100 ft) wide must maintained between the normal high water line and the activity; and

(b) upland surface water runoff must be diverted around the activity.

24. Erosion control structures must be installed at all four quadrants before placing of fill material at stream crossings where the finished roadway elevation is to be increased or the shoulder of the road is to be extended.

25. Water control for the culvert installations is to be carried out using one of the following methods:

(a) building the new structure in the dry and diverting the watercourse into it upon completion;

(b) constructing a temporary plastic lined diversion channel; or

(c) pumping the flow around the site, ensuring the pump runs at all times and the discharge is immediately downstream of the work area.

26. An excavator must be used to install the culvert(s) and place fill material over the pipe(s).

27. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These

photographs must be dated, signed by the proponent, and submitted to the Department along with the notification documents.

28. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the projects compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

12.0 Soil disturbance adjacent to a watercourse

12.1 Applicability

1. This category pertains to any disturbance of soil, including excavating, bulldozing grubbing, or tilling between 15 and 30 metres (50 to 100 ft) of the edge of the bank of a watercourse which causes on-site soil material to be exposed on an area no larger than 300 square metres (356 yds^2) (Figure 31).

Note: The Crown Lands and Forests Act controls activities on all land in the province controlled by the New Brunswick Department of Natural Resources and Energy.

12.2 Purpose

The conditions are designed to ensure that disturbed soil is stabilized to prevent erosion of the banks and shoreline of a watercourse and siltation of the water.

12.3 Conditions

1. Proponents are required to take photographs of the area in which the proposed activity is to take place, to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. In order to prevent surface water, which may carry sediment from exposed soil, from directly entering a watercourse:

(a) a strip of undisturbed vegetation at least 15 metres (50 ft) wide must be maintained between the normal high water line and the activity; and

(b) upland surface water runoff must be diverted around the activity.

4. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

5. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

6. All soil disturbance activities within any portion of the project must start and finish within a one month time frame.

7. If the area is not to be actively worked for more than one week, immediately stabilize disturbed soil using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

8. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yds^2) or 1 kilogram per square metre (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

9. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

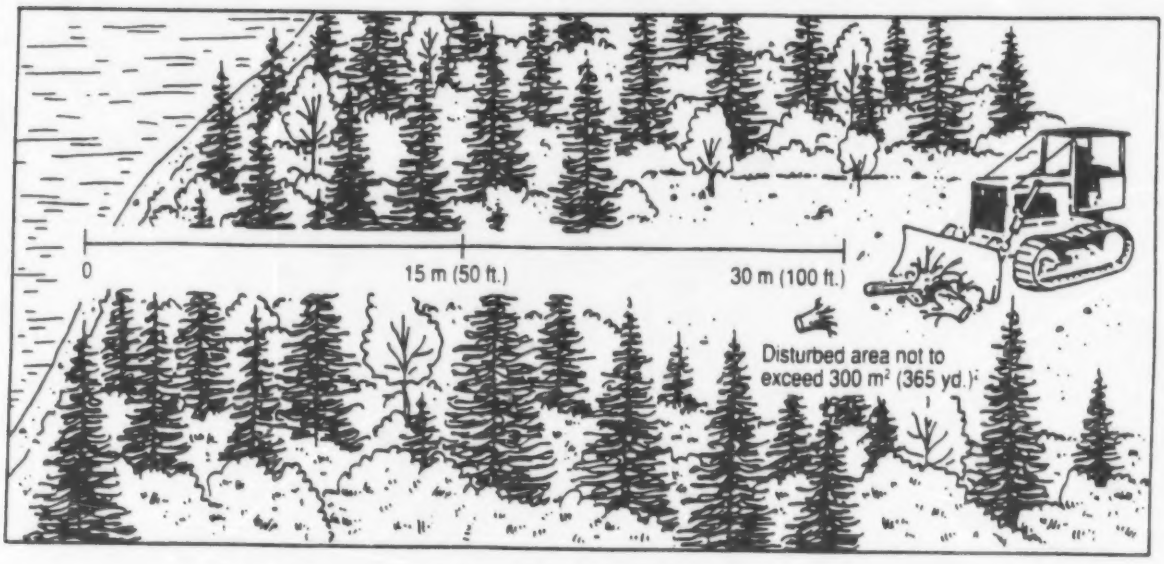


Figure 31. Any activities, such as grubbing and bulldozing that expose soil, which occur between 15 and 30 metres (50 to 100 ft) of a watercourse fall under the "soil disturbance adjacent to a watercourse" activity category. The disturbed area within this zone must not exceed 300 square metres (360 yd²) in size.

10. In addition to the placement of riprap, sod, erosion control blankets or hay mulch, additional steps must be taken where necessary to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

11. Prior to the start of the activity, hay bales and or filter fabric must be installed between the area to be altered and the watercourse to ensure that soil material does not enter the watercourse.

12. No heavy machinery is to be operated within 15 metres (50 ft) of the bank of the watercourse.

13.0 Intake pipes and instrument pools or wells

13.1. Applicability

1. This rule allows the installation and maintenance of permanent or temporary water intake pipes which will not significantly affect the level, flow or quality of water in a watercourse. Allowed uses for the purposes of this section include water supplies for single family residences and dry hydrants (Figure 32).

2. This rule allows installation and maintenance of permanent or temporary devices used to monitor water levels, flow or quality including staff gauges, hydrometric stations, and water quality testing devices.

3. This rule allows for the installation of fish counting fences and fish collection devices for scientific research.

4. Due to the potential for significant water level and flow reduction over a significant period of time, permanent water intakes for irrigation purposes, public water supplies and industrial or commercial uses, do not qualify for this section when located in a natural watercourse.

NOTE: In an area which affects a lake or pond, the placement of water lines or the installation of cables for utilities, such as telephone and power cables to serve a single family dwelling is exempt from permit requirements provided that:

(a) the excavated trench is immediately backfilled and riprapped to prevent erosion; and

(b) the excavated trench on the landward side of the riprapped area is immediately backfilled, seeded and mulched to prevent erosion.

13.2 Purpose

The conditions are designed to ensure that disturbed soil is stabilized in order to prevent erosion of the banks and shoreline of a watercourse, siltation of the water and the watercourse from being dewatered during low flow conditions.

13.3 Conditions for instrument pools, wells

1. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. The width of the disturbed area within 30 metres (100 ft) of the watercourse must be minimized to that necessary to install the device with the overall width being a maximum of 6 metres (20 ft).

4. The water intake must not obstruct any potential boat usage of the watercourse.

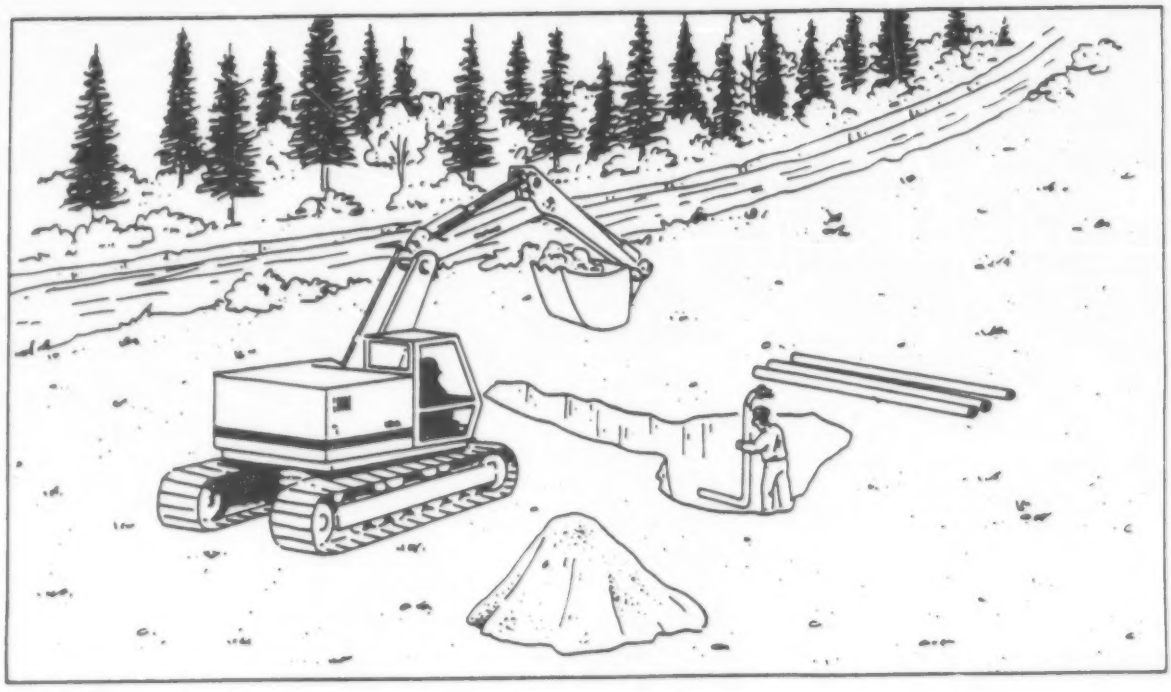


Figure 32. The construction of "dry hydrant" water intake structures falls under the intake pipes and "instrument pools or wells" activity category.

5. In rivers, streams, brooks or creeks the excavation of pools to increase depth is prohibited under this section.

6. Maintenance clearing of deposited debris and sediments from the intake area is allowed, provided the material is removed from the watercourse.

7. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

8. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

9. All soil disturbance activities within any portion of the project must start and finish within a one month time frame.

10. If the area is not to be actively worked for more than one week stabilize disturbed soil immediately using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

11. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yds^2) or 1 kg per square metre (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

12. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

13. In addition to the placement of riprap, sod, erosion control blankets, or hay mulch, additional steps must be taken where necessary to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion,

discoloration of water by suspended particles, and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

14. Riprap must not extend any higher on the bank than the level at which vegetation can be established to control erosion. Trees and shrubs shall be planted above the high water line to replace any vegetation that was removed.

15. When work is carried out in flowing watercourses less than 1 metre (3.3 ft) deep at the time and location of the work, the flow must be temporarily diverted to the opposite side of the channel while the work is in progress:

(a) sandwich 6 mil plastic sheeting between an inner wall of in situ earth material and an outer wall of either rocks, sandbags or a steel H-beam attached to the bottom of a 2.5 cm (1 in) thick sheet of plywood;

(b) all water pumped from inside the cofferdam must be discharged over an area of natural vegetation to filter out the suspended solids before it re-enters the watercourse, or into a settling pond such that the level of suspended solids in the watercourse does not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken 50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site;

(c) all material used to temporarily divert flow must be completely removed upon completion of the project and the watercourse substrate restored to its original condition;

(d) the inner wall of in situ earth material must be completely removed first prior to the removal of the remainder of the cofferdam.

16. No self-propelled, wheeled, or tracked heavy equipment shall be operated in the wetted portion of the watercourse except as follows:

(a) equipment may cross the watercourse on a rock, gravel or ledge bottom while carrying out the project;

(b) equipment stationed on shore may, where necessary, reach into the wetted portion of the watercourse with a bucket or similar extension;

(c) pumps may be operated, where necessary, for temporary diversions; and

(d) this restriction does not apply to boats and floating barges.

17. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water levels or low flow.

18. Uncured concrete must not be placed directly into the water. Concrete must be placed in forms and allowed to cure at least a week prior to form removal or must be pre-cast and cured at least three weeks before being placed in the water.

19. That the instrument pool or well be secured or protected from ice and other debris in the flow.

13.4 Conditions for water intakes for dry hydrants and bypass ponds

1. When water is being withdrawn by suction, an open area of 0.19 m^2 (2.0 ft^2) of screen must be provided for each 0.028 m^3/sec (1.0 ft^3/sec) of water being withdrawn.

2. The water intake structure must be constructed with bed and bank protection to adequately protect the watercourse and intake works from local erosion.

3. The pumping stations must be set up in a manner that will prevent accidental pollutant discharge, such as fuel and lubricants, from entering the watercourse.

4. The suction hose in a watercourse must be screened at the inlet.

5. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

6. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

7. If the area is not to be actively worked for more than one week, stabilize disturbed soil immediately, using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

8. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yds^2) or 1 kg per m^2 (1.8 lbs/yds^2) applied uniformly over the entire exposed area.

9. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

10. In addition to the placement of riprap, sod, erosion control blankets, or hay mulch, additional steps must be taken where necessary in order to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

11. No self-propelled, wheeled, or tracked heavy equipment shall be operated in the wetted portion of the watercourse except as follows:

(a) equipment may cross the watercourse on a rock, gravel or ledge bottom while carrying out the project;

(b) equipment stationed on shore may, where necessary, reach into the wetted portion of the watercourse with a bucket or similar extension;

(c) pumps may be operated, where necessary, for temporary diversions; and

(d) this restriction does not apply to boats and floating barges.

12. When the flow in the watercourse downstream of the intake drops below 25 percent of the mean annual flow at the site, sufficient water must be returned to the watercourse within 10 metres (33 ft) of the point of extraction to maintain this flow or the ambient flow whichever is less, unless the water is being used for fire fighting purposes.

14.0 Maintenance and stabilization of existing crossings and water-control structures

14.1 Applicability

1. This rule allows maintenance, repair, rehabilitation or stabilization of an existing facility which provides access to the opposite side of a watercourse without expanding its function. Activities which qualify consist of any of the following:

(a) rehabilitation of concrete piers and the invert of steel culverts with a new layer of concrete, provided the invert of the structure is not raised above the bed of the watercourse;

(b) the construction or replacement of timber or concrete headwalls and/or wingwalls (Figure 33);

(c) rehabilitation or repair of structures along railway lines; and

(d) reestablishment of the rock base and gravel surface of a ford and its approaches.

Note: This section does not apply to the placement of riprap.

14.2 Purpose

These conditions are designed to ensure that the replacement, addition or extension of a crossing structure will not:

1. interfere with any existing navigational uses;

2. cause the erosion of soil or siltation of the water;

3. interfere with the normal flow of water;

4. interfere with fish migration or spawning.

14.3 Conditions

1. Borrow pits must not be located within 30 metres (100 ft) of a watercourse.

2. A minimum of 15 cm (6 in) of water must overtop the structure at all times or flow channels must be built into the ford. These channels must be placed and maintained in such a manner so as not to impede fish migration.

3. No chemical sprayers or equipment carrying chemicals are to use the ford.

4. Nothing is to be skidded or dragged across the ford.

5. The ford must not be used if the water depth is greater than the axle height of the vehicle.

6. Vehicles using the ford shall be in good condition, and not losing fuel, lubricating oil, hydraulic fluids, or their cargo.

7. Fords must allow for fish passage at all times of the year and shall not impound water. Fords must also allow for normal stream flow to be maintained.

8. Fords shall be lined with stone, gabion blankets or geotextile material for erosion control when the natural bed material does not consist of ledge, bedrock or cobble substrate.

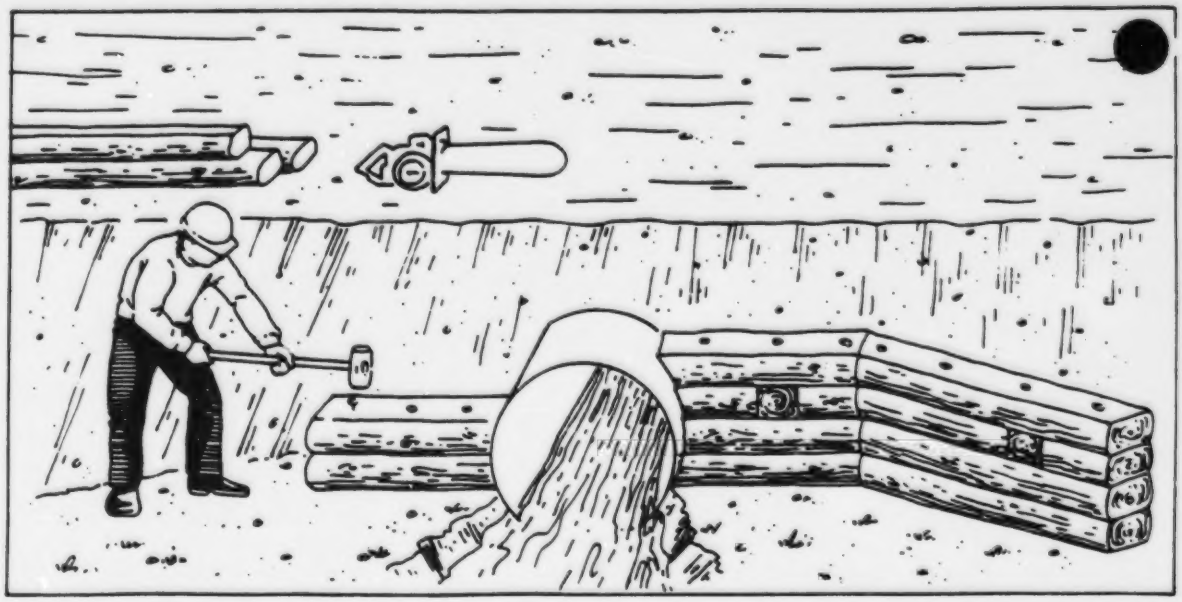


Figure 33. Constructing or replacing timber wingwalls and headwalls falls under the "maintenance and stabilization of existing crossings and water control structures" activity category.

9. Unstable approaches to a ford must be topped with clean non-erodible material for a minimum distance of 10 metres (33 ft) back from the water's edge.

10. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Water Quality Regulation under the Clean Environment Act which is administered by the Department of Environment.

11. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

12. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

13. Fill sideslopes within 30 metres (100 ft) of the watercourse must be maintained at a slope no steeper than 1.5 horizontal to 1 vertical and stabilized with hay mulch or geotextile fabric immediately upon final grades being reached.

14. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

15. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

16. If the area is not to be actively worked for more than one week, stabilize disturbed soil immediately, using temporary erosion control measures such as hay mulch, erosion control blankets, or other comparable measures.

17. When work is carried out in flowing watercourses less than one metre (3.3 ft) deep at the time and location of the work, the flow must be temporarily diverted to the opposite side of the channel while the work is in progress. Water diversion guidelines include:

(a) sandwich 6 mil plastic sheeting between an inner wall of in situ earth material and an outer wall of either rocks, sandbags or a steel H-beam attached to the bottom of a 2.5 cm (1 in) thick sheet of plywood;

(b) all material used to temporarily divert flow must be completely removed upon completion of the project and the watercourse substrate restored to its original condition;

(c) all water pumped from inside the cofferdam must be discharged over an area of natural vegetation to filter out the suspended solids before it re-enters the watercourse, or into a settling pond such that the level of suspended solids in the watercourse, does not increase more than 25 mg/l (25 ppm) above background levels, as determined by a grab sample taken 50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site; and

(d) the inner wall of in situ earth material must be completely removed prior to the removal of the remainder of the cofferdam.

18. No self-propelled, wheeled or tracked heavy equipment shall be operated in the wetted portion of the watercourse except as follows:

(a) equipment may cross the watercourse on a rock, gravel or ledge bottom while carrying out the project;

(b) equipment stationed on shore may, where necessary, reach into the wetted portion of the watercourse with a bucket or similar extension;

(c) pumps may be operated, where necessary, for temporary diversions; and

(d) this restriction does not apply to boats and floating barges.

19. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water level or low flow.

20. Uncured concrete must not be placed directly into the water. Concrete must be placed in forms and allowed to cure at least a week prior to form removal or must be pre-cast and cured at least three weeks before being placed in the water.

21. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

22. Suspended solid levels in the watercourse resulting from this project must not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken

50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site.

23. Wood treated with creosote or pentachlorophenol must not be used below the normal high water line.

24. Lumber pressure-treated with materials such as chromated copper arsenate must be cured on dry land such that all surfaces are exposed to the air for a period of at least 21 days prior to construction.

Note: Spacing lumber with small strapping is an acceptable method of exposing the surfaces.

25. Rocks must not be removed from below the normal high water line of any watercourse except to the minimum extent necessary for completion of the work within the construction limits.

26. All soil disturbance activities within any portion of the project must start and finish within a one month time frame.

27. All bed material removed from inside the culvert must be removed manually and spread evenly along the shoreline below the normal high water line.

15.0 Debris removal

15.1 Applicability

This rule allows for the removal of debris from below the normal high water line by hand provided no bed or bank material is disturbed or vegetation destroyed (Figure 34).

Figure 34. The "debris removal" activity category applies to the removal, by hand, of trash and dead or decaying vegetation from below the normal high water line of a watercourse.

15.2 Purpose

These standards are designed to:

1. limit the disturbance of materials on the bed of a watercourse, and to prevent the loss of excessive amounts of bottom materials which are necessary to provide habitat for fish and other aquatic organisms;

2. prevent motorized equipment from conveying silt into another area by limiting the work to removal by hand;

3. ensure that organic debris neither interferes with navigation nor increases the biochemical oxygen demand as it decomposes, by requiring the removal of cut or uprooted vegetation from the watercourse.

15.3 Conditions

1. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. Logs firmly embedded in the streambed over which flow passes must not be removed if the resulting head is less than 0.3 metres (1 ft).

4. No heavy machinery is to be operated within 15 metres (50 ft) of the bank of the watercourse.

5. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water level or low flow.

6. If the area is not to be actively worked for more than one week, disturbed soil must be immediately stabilized using temporary erosion control measures such as hay mulch, erosion control blankets, or other comparable measures.

7. Bushes, weeds, and small trees growing within 15 metres (50 ft) of the watercourse must not be removed.

8. In rivers, streams, brooks or creeks, the excavation of pools to increase depth is prohibited under this section.

9. The project must not permanently block fish passage in any watercourse beyond already-existing obstructions and must improve fish passage whenever possible.

16.0 Road construction adjacent to a watercourse

16.1 Applicability

1. This rule allows for the construction of private driveways and access roads on private land to within 15 metres (50 ft) of the edge of the bank of a watercourse.

2. This rule allows for the construction of a private road within 15 and 30 metres (50 and 100 ft) of the edge of the bank of a watercourse for a total distance of 300 metres (984 ft) or less (Figure 35).

3. This rule shall not apply to the placement of fill below the normal high water line of a watercourse.

16.2 Purpose

The standards are designed to ensure that the construction or reconstruction of a private transportation facility will not:

1. cause erosion of disturbed soil or fill material and siltation of the water;

2. harm wildlife or fisheries habitat.

16.3 Conditions

1. The project must not alter more than 300 metres (984 ft) of the strip of land situated at least 15 metres (50 ft) and less than 30 metres (100 ft) from the edge of the bank of a watercourse (both banks added together) within a 2.0 km (1.2 mi) stretch along the watercourse.

2. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

3. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

4. (a) In order to prevent surface water which may carry sediment from exposed soil from directly entering a watercourse:

(i) a strip of undisturbed vegetation at least 15 metres (50 ft) wide must maintained between the normal high water line and the activity;

(ii) upland surface water runoff must be diverted around the activity.

(b) These undisturbed vegetative strip requirements do not apply to:

(i) approaches to new road crossings;

(ii) vegetative stabilization measures undertaken to control erosion;

5. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

6. If the area is not to be actively worked for more than one week, stabilize disturbed soil immediately using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

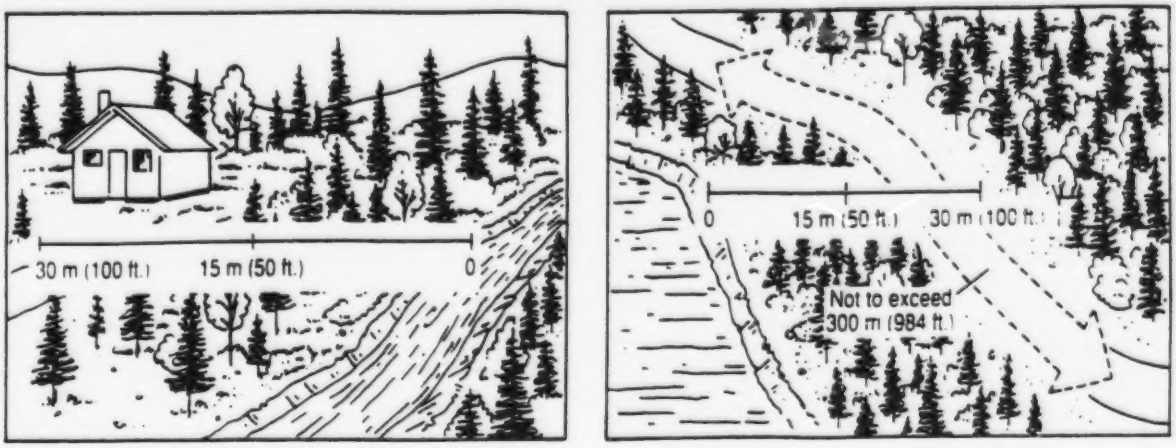


Figure 35. The "road construction" activity category pertains to private driveways and access roads built between 15 and 30 metres (50 to 100 ft) of the edge of the bank of a watercourse. Road construction is limited to no more than 300 metres (984 ft) in length within this zone.

7. Hay mulch, where used, must be applied at a rate of at least one bale per 25 m^2 (30 yds^2) or 1 kg per square metre (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

8. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

9. In addition to the placement of riprap, sod, erosion control blankets, or hay mulch, additional steps must be taken where necessary in order to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

10. Suspended solid levels in the watercourse resulting from this project must not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken 50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site.

11. No fill other than the riprap and gravel may extend below the normal high water line.

12. Rocks used for riprap must have an irregular shape and be no smaller dimension of not less than 15 mm (6 in).

13. Rocks used for riprap must not be obtained from the bed or banks of the watercourse because they help prevent erosion and provide habitat for aquatic life.

14. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations,

except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water levels or low flow.

15. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Water Quality Regulation under the Clean Environmental Act which is administered by the Department of Environment.

16. Fill sideslopes within 30 metres (100 ft) of the watercourse must be maintained at a slope no steeper than 1.5 horizontal to 1 vertical.

17. The portion of the access road below the high water mark must be constructed or stabilized with non-erodible material obtained from a non-watercourse source.

18. No instream work is to be carried out at anytime during this project.

19. No material is to be deposited in, or removed from, the watercourse.

20. No heavy machinery is to be operated within 15 metres (50 ft) of the bank of the watercourse.

21. Sediment traps must be constructed along the ditch of the road at spacings determined by dividing 500 metres (1640 ft) by the grade of the ditch (in percent).

17.0 Replacing undesirable vegetation

17.1 Applicability

1. This rules allows the cutting of undesirable vegetation from privately owned residential or recreational property within 15 metres (50 ft) of the edge of the bank of a watercourse, and replacing it with desirable species of trees, bushes, and grass provided (Figure 36):

(a) the area is not grubbed;

(b) the distance of the watercourse does not exceed 55 metres (180 ft);

(c) the material cut isn't utilized as a commercial product; and

(d) no heavy, tracked, or wheeled equipment is operated within 15 metres (50 ft) of the edge of the bank of the watercourse.

2. This rule does not allow for the harvesting of marketable timber.

17.2 Purpose

The standards are designed to ensure that vegetation removal and replacement activities are conducted in a manner that will not cause siltation of the water, have an adverse affect on aquatic life, food or habitat, or cause bank destabilization.

17.3 Conditions

1. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

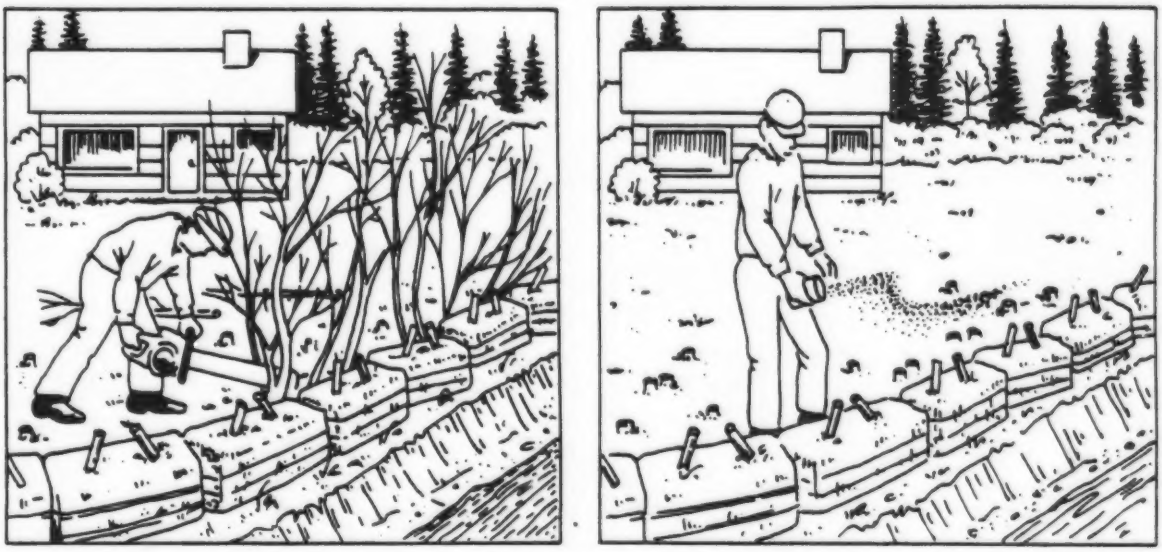


Figure 36. Unwanted vegetation growing within 15 metres (50 ft) of a watercourse may be cut and replaced with desirable species of trees, bushes, and grasses, under the "replacing undesirable vegetation" activity category.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. All soil disturbance activities within any portion of the project must start and finish within a one month time frame.

4. If the area is not to be actively worked for more than one week, immediately stabilize disturbed soil using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

5. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yds^2) or 1 kg per square metre (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

6. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

7. Prior to the start of the activity, hay bales and/or filter fabric must be installed between the area to be altered and the watercourse to ensure that soil material does not enter the watercourse.

8. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from spring runoff, storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water level or low flow.

9. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Water Quality Regulation under the Clean Environment Act which is administered by the Department of Environment.

10. Should the banks of the watercourse be disturbed by any activity associated with this project, they must be immediately stabilized to prevent erosion.

11. No material is to be deposited in, or removed from, the watercourse.

12. No instream work is to be carried out at anytime during this project.

13. Undesirable vegetation must be replaced with a sufficient quantity of desirable species of trees to provide bank stability and adequate shade to prevent a rise of water temperature which could adversely affect fish, fish food and fish habitat.

14. No heavy machinery is to be operated within 15 metres (50 ft) of the bank of the watercourse.

18.0 Bush cutting adjacent to a watercourse

18.1 Applicability

This rule allows for the cutting of all vegetation from a strip not exceeding 6 metres (20 ft) in width to facilitate access to the water, provide for a view of the water, or facilitate the stringing of conductors such as telephone and power cables, provided no grubbing is carried out within 30 metres (100 ft) of the edge of the bank of a watercourse (Figure 37).

Figure 37. The "bush cutting adjacent to a watercourse" activity category allows landowners to cut all vegetation from a strip not greater than 6 metres (20 ft) in width to provide access to, or a view of, a watercourse.

18.2 Purpose

The standards are designed to ensure that vegetation removal and replacement activities are conducted in a manner that will not cause siltation of the water, have an adverse affect on aquatic life, food or habitat, or cause bank destabilization.

18.3 Conditions

1. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

4. If the area is not to be actively worked for more than one week, stabilize disturbed soil immediately using temporary erosion control measures such as hay mulch, erosion control blankets or other comparable measures.

5. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yds^2) or 1 kg per square metre (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

6. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is

permanently stabilized with other permanent control measures.

7. In addition to the placement of riprap, sod, erosion control blankets, or hay mulch, additional steps must be taken where necessary in order to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

8. Suspended solid levels in the watercourse resulting from this project must not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken 50 metres (164 ft) upstream of the work site and near the centre of the plume 50 metres (164 ft) downstream of the work site.

9. Maintenance clearing of deposited debris and sediments from the intake area is allowed provided the material is removed from the watercourse.

10. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Water Quality Regulation under the Clean Environment Act which is administered by the Department of Environment.

11. No heavy machinery is to be operated within 15 metres (50 ft) of the bank of the watercourse.

12. No trees are to be felled across or into the watercourse.

13. Grappling, bucking, winching and manual methods must be used when removing trees and brush within 15 metres (50 ft) of the banks of a watercourse.

14. On Crown Land, a "Letter of Authority to Occupy" under the Crown Lands and Forests Act must be obtained from the Crown Lands Branch of the New Brunswick Department of Natural Resources and Energy prior to starting the project.

15. Should the banks of the watercourse be disturbed by any activity associated with this project, they must be immediately stabilized to prevent erosion.

16. No material is to be deposited in, or removed from, the watercourse.

17. No instream work is to be carried out at anytime during this project.

19.0 Storm sewer outfall pipes

19.1 Applicability

1. This rule allows for the installation, maintenance and stabilization of permanent outfall pipes, ditches and drain tiles for storm water, and groundwater overflows within 30 metres (100 ft) of the edge of the bank of a watercourse (Figure 38).

19.2 Purpose

The standards are designed to ensure that an outfall does not result in soil erosion, siltation of the water, interference with the natural flow of water, interference with navigation or disturbance of aquatic habitat.

19.3 Conditions

1. Proponents are required to take photographs of the area in which the proposed activity is to take place to serve as a record of existing conditions. These photographs must be dated, signed by the proponent and submitted to the Department along with the notification documents.

2. Within 21 days of project completion and stabilization of disturbed areas, as required, additional photographs depicting the project's compliance with the conditions contained herein must be submitted to the Department. These photographs must be dated and signed by the applicant.

3. The width of the disturbed area within 30 metres (100 ft) of the watercourse must be minimized to that necessary to install the device, with the overall width being a maximum of 6 metres (20 ft).

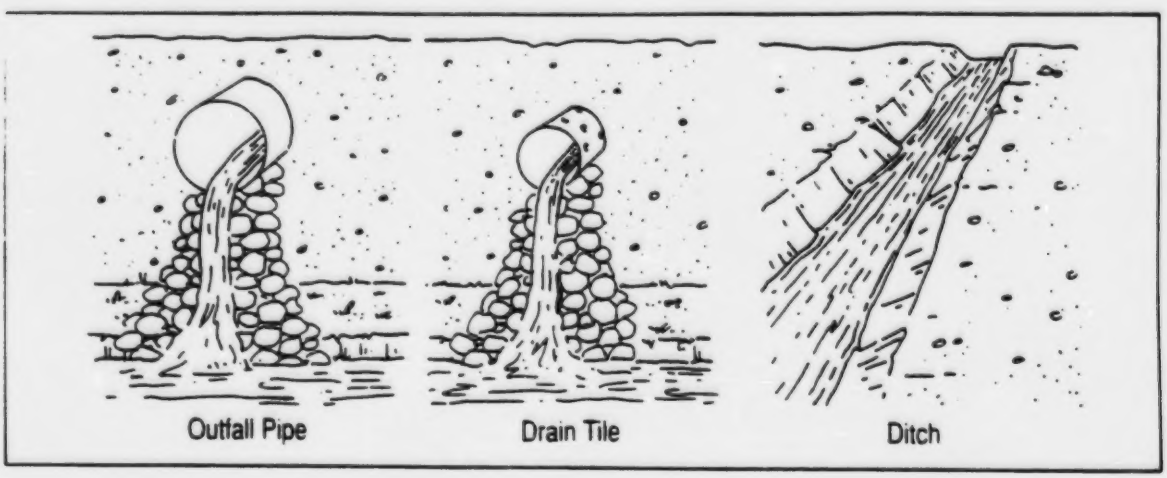


Figure 38. Outfall pipes, drain tiles, and ditches for storm and ground water flows may be installed, maintained, or stabilized within 30 metres (100 ft), of a watercourse under the "storm sewer and outfall pipes" activity category.

4. A rock apron must be constructed below the outfall if the discharge may otherwise cause erosion.

5. If the outfall is under water, sufficient water depth over the outfall structure must be maintained for potential boat usage of the project area.

6. Mulch or other temporary erosion control measures must be maintained until a catch of vegetation is established over the entire disturbed area or the site is permanently stabilized with other permanent control measures.

7. No self-propelled, wheeled, or tracked heavy equipment shall be operated in the wetted portion of the watercourse except as follows:

(a) equipment stationed on shore may, where necessary, reach into the wetted portion of the watercourse with a bucket or similar extension;

(b) pumps may be operated, where necessary, for temporary diversions; and

(c) this restriction does not apply to boats and floating barges.

8. No work below the normal high water line of a watercourse shall be done during periods of elevated water levels resulting from storm events or dam operations, except where necessary to protect work in progress. Work shall otherwise be limited to a period of low water levels or low flow.

9. Uncured concrete must not be placed directly into the water. Concrete must be placed in forms and allowed to cure at least a weekprior to form removal or must be pre-cast and cured at least three weeks before being placed in the water.

10. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Clean Environment Act administered by the Department of Environment.

11. No soil shall be disturbed during any period when soils are saturated with rain or snow melt.

12. Prior to starting an activity, erosion control measures must be installed and adequately maintained to prevent the discharge of sediment into a watercourse.

13. Rocks must not be removed from below the normal high water line of any watercourse except to the minimum extent necessary for completion of the work within the construction limits.

14. When work is carried out in flowing watercourses less than 1 metre (3.3 ft) deep at the time and location of the work, the flow must be temporarily diverted to the opposite side of the channel while the work is in progress. Water diversion guidelines include:

(a) sandwich 6 mil plastic sheeting between an inner wall of in situ earth material and an outer wall of either rocks, sandbags or a steel H-beam attached to the bottom of a 2.5 cm (1 in) thick sheet of plywood;

(b) all water pumped from inside the cofferdam must be discharged over an area of natural vegetation to filter out the suspended solids before it re-enters the watercourse, or into a settling pond such that the level of suspended solids in the watercourse does not increase more than 25 mg/l (25 ppm) above background levels as determined by a grab sample taken

50 metres (164 ft) upstream of the site and near the centre of the plume 50 metres (164 ft) downstream of the site;

(c) all material used to temporarily divert flow must be completely removed upon completion of the project and the watercourse substrate restored to its original condition; and

(d) the inner wall of in situ earth material must be completely removed prior to the removal of the remainder of the cofferdam.

15. If the area is not to be actively worked for more than one week, stabilize disturbed soil immediately using temporary erosion control measures such as hay mulch, erosion control blankets, or other comparable measures.

16. Hay mulch, where used, must be applied at a rate of at least one bale per 25 square metres (30 yd^2) or 1 kg per square metre (1.8 lbs per yd^2) applied uniformly over the entire exposed area.

17. In addition to the placement of riprap, sod, erosion control blankets, or hay mulch, additional steps must be taken where necessary in order to prevent sedimentation of the water. Evidence of sedimentation includes visible gully erosion, discoloration of water by suspended particles and slumping banks. Silt fences, staked hay bales or other sedimentation control measures must be in place prior to commencement of any work, and shall be installed wherever necessary due to sedimentation.

18. A 30 metre (100 ft) wide buffer strip must not be grubbed until all material and equipment is on site ready to begin the installation of the outfall pipe.

20.0 Selective harvesting of timber within 30 metres (100 ft) of a watercourse

20.1 Applicability

1. This rule allows for the harvesting of 30% of only the marketable trees located within 30 metres (100 ft) of the edge of the bank of a watercourse, measured horizontally. Trees harvested must be evenly distributed throughout the area to be cut (Figure 39).

2. This rule allows for the harvesting of 30 percent of the marketable trees in the same area once every ten years.

3. This rule does not allow for the operation of wheeled or tracked harvesting equipment within 15 metres (50 ft) of the edge of the bank of a watercourse.

20.2 Purpose

The standards are designed to ensure that timber harvesting activities are conducted in a manner that will not cause siltation of the water, have an adverse affect on aquatic life, food or habitat, or cause bank destabilization.

20.3 Conditions

1. No trees are to be felled across or into the watercourse.

2. Any debris generated during the project must be prevented from washing downstream and must be removed from the watercourse. Disposal of debris must be in conformance with the Water Quality Regulation under the Clean Environment Act which is administered by the Department of Environment.

Figure 39. Thirty percent of marketable trees growing within 30 metres (100 ft) of a watercourse can be harvested once every 10 years under the "selective harvesting of timber within 30 metres of a watercourse" activity category.

3. No primary forest product is to be stacked within 15 metres (50 ft) of a watercourse.

4. No tops, slash, debris or primary forest product from a harvesting operation shall be allowed to enter a watercourse.

5. Wheeled or tracked harvesting equipment must not track within 15 metres (50 ft) of the edge of the bank of a watercourse.

6. Harvesting operations within 30 metres (100 ft) of the edge of the bank of a watercourse must not result in the exposure of erodible soil material.

7. No alders, bushes or trees which are smaller than market size may be cut or uprooted within 30 metres (100 ft) of a watercourse.

8. All trees and slash deposited below the normal high water line must be removed and disposed of such that they cannot enter the watercourse during high flow.

Appendices

Appendix A

Watercourse Alteration Application Form

(In accordance with the Watercourse Alteration Regulation under the Clean Water Act, Chapter C-6.1, Acts of New Brunswick 1989)

I have submitted this application on behalf of: (Please Print)

NAME OF APPLICANT

(Dept/Company/Group/Person _____

Mailing Address _____

_____

Telephone Bus: _____ Home: _____ Fax: _____

If different from above:

Contact Person: _____ Telephone: _____

The applicant accepts the liability for any damage done while commencing, carrying out, or completing the watercourse alteration(s) described herein.

Name of Watercourse _____ Tributary to _____

County _____ Parish _____

FOR OFFICE USE ONLY

_____ Accepted for processing. Required fee of $_____ enclosed.

_____ Not accepted for processing and will be returned to the applicant.

_____ Resubmitted for processing.

Category _____ Type _____ DFO Region _____

Easting _____ Northing _____ Zone _____

1:50,000 Map Sheet _____

EIA Screen _____ Water Supply _____

Water Quality Certificate _____ DNR Region _____

Date _____ Signature _____
Day Month Year

Copies _____

A. Description of Alteration

Please include a detailed description of the project including: type of alteration, description of construction method, including materials used, disturbed surface area within 30 metres of the watercourse and the purpose of the project.

NOTE: If your project involves a culvert installation, you must include culvert dimensions and type. If your alteration involves a bridge, you must include the rise (distance from the streambed to the underside of the stringers) and span (the distance between abutments) and average bed material type and size.

Equipment to be used in the wetted portion of the channel _____

NOTE: Instream work should be completed during the low water period which is between the months of June and September, inclusive, in order to lessen potential damage to the environment. All requests for permits outside this time frame will require input from our advisory agents and may be rejected or subjected to intensive fish habitat protection measures.

Desired period of construction: _____ _____
Month Day Year to Month Day Year

Desired period for instream work: _____ _____
Monthy Day Year to Month Day Year

The period of instream work is necessary beyond the June to September period because:

B. Location

Please submit a **map** which clearly shows the location of your proposed project relative to **well known** and labelled landmarks such as watercourses, railways, roads and/or transmission lines, etc.

Copies of the relevant **maps** may be obtained from any office of:

New Brunswick Department of the Environment New Brunswick Department of Natural Resources and Energy New Brunswick Department of Agriculture New Brunswick Department of Transportation The Federal Department of Fisheries and Oceans

C. Description of Watercourse (you may submit a photograph)

Are the banks of the watercourse eroding in the vicinity of the proposed project?

_____

If this structure replaces an existing structure, give details on the existing structure.

_____

What is the width of the watercourse from edge of bank to edge of bank?

_____

What is the height of the right bank (looking downstream)?

_____

What is the height of the left bank (looking downstream)?

_____

D. Application Fee

I have enclosed the required fee of $_____ in the form of a ___ money order, _____ cheque made payable to the **Minister of Finance.**

E. Sketch of the Project

Please enclose a sketch of the proposed project including all distances and dimensions with respect to the watercourse. This sketch is not intended to be a location sketch.

NOTE: For culvert installations, you must indicate length, slope and alignment relative to the existing channel.

F. Declaration of Applicant

I hereby request a permit to commence, make, or carry out the watercourse alteration as described on this application form. It is understood that the submittal of this application does not allow the applicant to commence, make or carry out the alteration as described in this application.

It is understood that the issuance of a permit does not exempt the applicant from the provisions of any Act of the Legislature of New Brunswick or the Parliament of Canada, or any due process of law including any municipal by-laws. It is acknowledged that the issuance of the permit does not serve to deprive any person of his rights either under statute or common law to claim damages for loss or injury caused to him or his property by reason of the watercourse alteration. It is understood that the issuance of a permit places no liability upon the Minister or the Department of the Environment.

If issued a permit, it is agreed that only such work as approved on the permit shall be carried out and all such work shall be done so as to cause a minimum of disturbance to the watercourse.

Landowners: It is the responsibility of the applicant to obtain the approval of the landowner where the alteration is to take place as well as the approval of the adjacent landowners who might be affected by the alteration. If the adjacent land which might be affected by the alteration is owned by the crown in the right of the Province of New Brunswick, the applicant should obtain the approval of the New Brunswick Department of Natural Resources and Energy, Crown Lands Branch. If the alteration is to take place within an incorporated municipality or within the boundaries of a Planning District, the applicant should obtain the necessary approvals and ensure that the municipal and planning by-laws are not violated.

I certify to the best of my knowledge that the information stated in this form is correct.

Date: _____ Signature of Applicant _____

NOTE: Please enclose the required documents. Failure to submit adequate information in each section of this application will result in the application either being returned or rejected.

Appendix B

Watercourse Alteration Permit Examples

(Regulation 90-80 under the Clean Water Act
chapter C-6.1 of the revised statutes of New Brunswick 1973)

Culvert Installation

LOCATION: 554 750M Easting; 5 252 000M Northing; Zone 19

WATERCOURSE: Unnamed **COUNTY:** Madawaska

TRIBUTARY TO: Iroquois River **PARISH:** Saint Basile

PERMIT COVERS PERIOD: From August 25th, 1992 to September 30th, 1992, only.

DESCRIPTION OF WATERCOURSE ALTERATION(S): This project consists of the construction of a wooden box culvert, having a minimum waterway opening of 0.79 square metres, over the watercourse to provide access for timber harvesting operations.

The Permittee may undertake only those watercourse alteration(s) described above hereby approved by the Minister. Refer to Conditions of Approval stated on the attached Document "A". Responsibility for any action arising from any watercourse alteration must be borne by the Permittee from the provisions of any Act of the Legislature of New Brunswick or of Canada to serve as a legal defense to any action commenced by landowners who are adversely affected by the alteration.

Date of Issuance: August 14, 1992

Approved By: _____
JANE BARRY
Minister of Environment

Document "A" attached to alt.6606'92

Conditions of Approval

(1) that any debris and excavated material be removed from the watercourse and adjacent areas and disposed of, or placed in a manner where it cannot be returned to the watercourse;
(2) that all necessary precautions be taken to prevent discharge or loss of any harmful material or substance into the watercourse; including but not limited to creosote, hydrocarbons, biocides, fresh cement, lime, paint or concrete;
(3) that exposed material resulting from cut and fill operations be stabilized against erosion as soon as possible to reduce siltation of the watercourse;
(4) that machinery and pollutants be located in areas not in danger of floodwaters;
(5) that water control for the culvert installations be carried out using one of the following methods:
(a) building the new structure in the dry and diverting the stream into it upon completion;
(b) constructing a temporary plastic lined diversion;
or (c) stemming the flow upstream of the structure and pumping the flow around the site ensuring the pump runs at all times and the discharge is immediately downstream of the work area;
(6) that the culvert(s) extend a minimum of 0.3 metres beyond the upstream and downstream toe of the fill placed around the structure;
(7) that riprap or wingwalls be placed at both the upstream and downstream sides of the structure to help prevent erosion;
(8) that riprap be clean, inorganic, non-ore-bearing, non-toxic material obtained from a non-watercourse source;
(9) that any debris generated during the project be prevented from washing downstream, removed from the watercourse and project area and disposed of in the proper manner;
(10) that the waterway opening under the structure be a minimum of 0.79 square metres;
(11) that the minimum distance from the bed of the watercourse to the under side of the deck be 0.762 metres;
(12) that the structure be constructed such that the span does not constrict the natural flow of the water;
(13) that none of the material used to build the approaches to the structure be obtained within 30 metres of the watercourse;
(14) that the bridge be constructed with squared tamarack, hemlock or similar type of wood which has a long life span;
(15) that no grubbing be carried out within 30 metres of the watercourse except where necessary to remove stumps under the road bed and then not until construction of the crossing is ready to begin;
(16) that the maximum slope of the shoulder of the road be 1.5 horizontal to 1 vertical within 30 metres of a watercourse;
(17) that no machinery be stationed in the wetted portion of the watercourse; machinery operating on shore may reach into the water with an extension.

Bridge Construction

LOCATION: 282 210M Easting; 5 078 350M Northing; Zone 20

WATERCOURSE: Unnamed **COUNTY:** Kings

TRIBUTARY TO: Salmon Creek **PARISH:** Johnston

PERMIT COVERS PERIOD: From June 26th, 1991 to September 30th, 1991, only.

DESCRIPTION OF WATERCOURSE ALTERATION(S): This project consists of the construction of a wooden bridge with a minimum waterway opening of 12 square feet. The purpose of this project is to provide access to the applicant's woodlot.

The Permittee may undertake only those watercourse alteration(s) described above hereby approved by the Minister. Refer to Conditions of Approval stated on the attached Document"A". responsibility for any action arising from any watercourse alteration must be borne by the Permittee and no liability shall be incurred by the Minister or the Department of the Environment. This permit does not exempt or exclude the Permittee from the provisions of any Act of the Legislature of New Brunswick or of Canada to serve as a legal defense to any action commenced by landowners who are adversely affected by the alteration.

Date of Issuance: June 26, 1991

Approved By: _____
VAUGHN BLANEY
Minister of the Environment

Document "A" Attached to Alt. 5448'91

Conditions of Approval

(1) that any debris and excavated material be removed from the watercourse and adjacent areas and disposed of, or placed in a manner where it cannot be returned to the watercourse; (2) that all necessary precautions be taken to prevent discharge or loss of any harmful material or substance into the watercourse; including but not limited to creosote, hydrocarbons, biocides, fresh cement, lime, paint or concrete; (3) that exposed material resulting from cut and fill operations be stabilized against erosion as soon as possible to reduce siltation of the watercourse; (4) that machinery and pollutants be located in areas not in danger of floodwater; (5) that the bridge abutments be aligned so as not to direct the flow into the banks of the watercourse; (6) that the bridge be constructed such that the span does not constrict the flow of the watercourse; (7) that riprap or wingwalls be placed at both the upstream and downstream side of the structure to help prevent erosion of the channel; (8) that riprap be clean, inorganic, non-ore-bearing, and non-toxic material obtained from a non-watercourse source; (9) that cofferdams be used around the abutments such that the working areas are protected and at least two-thirds of the channel cross-section is maintained open at all times; (10) that runoff ditches not discharge directly into any watercourse until all exposed material is stabilized against erosion; (11) that a buffer strip of ungrubbed area at least 30 metres wide be maintained on both sides of the watercourse; (12) that none of the material used to construct the approaches to the crossing be obtained from within 30 metres of the watercourse.

Appendix C

Provisional Permit Notification Form

(In accordance with the Watercourse Alteration Regulation under the Clean Water Act)

Name of Applicant: _____

Address: _____

Postal Code: _____ Tel. No.: _____ Fax. No: _____

LOCATION OF ACTIVITY

Name of Watercourse: _____ Tributary: _____

County: _____ Parish: _____

Description of Proposed Project: _____

_____

Attach to this form a location map with project site clearly marked. Either 1:50,000 scale topographic, Department of Transportation District highway or 10:000 or 1:20,000 scale orthophoto or municipal mapping is acceptable. Photographs showing existing site conditions must also be attached for all activities allowed under a Provisional Permit.

STATEMENT OF INTENT

I am filing notice of my intent to carry out work which meets the requirements for a Provisional Permit under the Watercourse Alteration Regulation. I will comply with Section 1 and all the conditions contained in the Section(s) checked below:

___ Sec. (2) Riprap
___ Sec. (3) Adding to or replacing an existing culvert or single span bridge
___ Sec. (4) Soil disturbance adjacent to a watercourse
___ Sec. (5) Intake pipes and instrument pools or wells
___ Sec. (6) Maintenance and stabilization of existing structures
___ Sec. (7) Debris removal
___ Sec. (8) Road construction adjacent to a watercourse
___ Sec. (9) Replacement of undesirable vegetation
___ Sec. (10) Bush cutting adjacent to a watercourse
___ Sec. (11) Storm sewer outfall pipes
___ Sec. (12) Selective timber harvesting within 30 metres of a watercourse

I authorize staff of the Departments of the Environment, Fisheries and Oceans and Natural Resources and Energy to access the project site for the purpose of determining compliance with the conditions. I also understand that this permit is not valid until an acknowledgement has been received from the Department of the Environment.

Signature of Applicant: _____ Date: _____

Send the original form with attachments to the **Dept of the Environment, Operations Branch**
PO Box 6000, Fredericton, NB E3B 5H1

The required fee of ten (10) dollars in the form of a money order or cheque made payable to the Minister of Finance must be enclosed with the notification form. Retain pink copy as a record of the permit. Permits are valid upon receipt by DOE for two years providing the project is started and completed between June 1st and September 30th of the same year. Permits obtained under this section are invalid if any of the applicability criteria or conditions have not been met. Violations of the Watercourse Alteration Regulation are subject to enforcement action, including a fine of up to $50,000 for an individual and $1,000,000 for persons other than an individual for each day of violation. A copy of the notification form and applicable conditions must be kept on site while the project is being carried out.

Appendix D

"Surface Watershed Protection Program"
Watercourse Setback Designation

Enclosed you will find the following:

1) Information entitled **Surface Watershed Protection Program: Watercourse Setback Designation.**

2) A copy of the **Watercourse Setback Designation Order** under the Clean Water Act, and,

3) A form to request an exemption from the Minister.

If you have any questions, please contact:

Environmental Planning and Sciences Branch
N.B. Department of the Environment
P.O. Box 6000, 364 Argyle Street
Fredericton, New Brunswick
E3B 5H1

Telephone: (506) 457-4846 (collect)
Fax: (506) 457-7823

Copies available in french
Copies disponibles en français

April 1, 1994

Introduction

Clean water is essential to all living things - not just people, but also wildlife, trees, plants and the thousands of tiny organisms which are vital to a healthy environment. It supports our present quality of life, and enables us to enjoy many recreational activities.

In New Brunswick, about 300,000 residents - 40% of the population - obtain their water supplies from surface **watersheds**. A watershed is an area of land that drains a system of streams, lakes and rivers (called **watercourses**). Perhaps you live within a watershed, or get drinking water from one. Either way, watershed protection affects you and every member of your community.

One contaminated watershed can mean undrinkable water for thousands of people. It could ruin the environment for countless large and small creatures. What's more, cleaning up the damage can take a great deal of time and money. It's far better to prevent contamination in the first place - which is why the New Brunswick government has developed a **Watershed Protection Program**.

The Watershed Protection Program and its legislation contain three key features.

- It identifies 31 watershed areas (called **designated watersheds**) that supply municipal drinking water for the province. The watersheds included under the Watercourse Setback Designation are listed near the end of this document.

- It marks out a protected area called a **setback zone** for each designated watershed. This area consists of the entire zone within 75 metres (250 ft) back from the banks of most watercourses within the watershed. The setback zone creates a buffer between watercourses and potentially harmful activities.

- It defines setback zones, and what can occur within them, through the **Watercourse Setback Designation Order**. Permitting only certain activities inside these protected areas helps to lessen the risk of watercourse contamination.

The Watercourse Setback Designation, which came into effect in New Brunswick on November 8, 1990, sets aside **protected areas (setback zones)** in these watersheds. Within these protected areas certain developments or activities are restricted or prohibited. Amendments to the Watercourse Setback Designation Order will take effect on April 1, 1994. These amendments are indicated in this document by the shaded areas.

The Watercourse Setback Designation is written in such a way that all developments, activities, or things not described within the Watercourse Setback Designation are prohibited within a protected area.

This information package will explain what the protected areas are and what developments or activities are allowed within a protected area. It will also explain how to find out whether or not all or part of your property contains a protected area. A form to request an exemption from the Minister of the Environment if you are unable to comply with the Watercourse Setback Designation is also included.

What is a protected area (setback zone) ?

The protected area, as designated under the Watercourse Setback Designation, is the area within a distance of 75 metres (250 ft) measured horizontally from the bank of watercourses (brooks, rivers, lakes, etc.). Within this area, to protect the drinking water, land use activities are limited (Figure A1).

This protected area serves to prevent sediments, pollutants and contaminants from reaching rivers, streams, lakes and other watercourses within the watersheds. These protected areas must be established throughout the province, to provide protection to municipal water supplies.

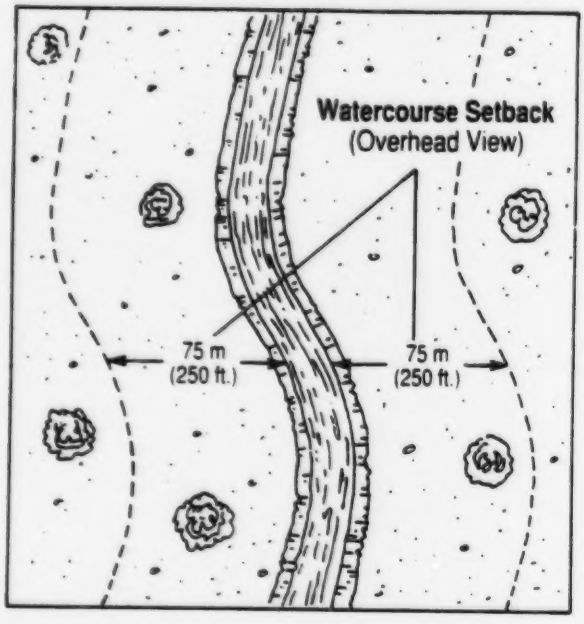


Figure (A1) Under the Watercourse Setback Designation, a protected area is the area within 75 metres (250 ft), measured horizontally, on each side of specially designated watercourses.

Why not just treat the water ?

It is important to understand that a municipal water treatment system does not always guarantee a safe water supply. Even the most effective treatment processes may not control certain viruses in the water or remove unwanted chemicals for a reasonable cost. In most cases, in fact, water which has already been contaminated cannot be restored to its original quality through treatment without excessive cost. The cost of building and maintaining water treatment facilities is also very high, especially for smaller communities. Additionally, there is always the risk of mechanical failure which can result in disruptions to water supply.

The best and most inexpensive way to provide safe water is to prevent it from becoming contaminated in the first place. The best way to accomplish this is by setting standards for land and water use within the watershed areas.

Who benefits from watershed protection ?

Over 300,000 people, nearly half of New Brunswick's population, depend on water supplied from a surface watershed, ... and that means we must do everything we can to protect these watersheds. While complying with the Watercourse Setback Designation will require adaptation on the part of some companies and individuals, there are long-term benefits in watershed protection. Landowners will be ensuring the value of their property; a protected watershed makes a better habitat for wildlife, and future generations will benefit from the provision of clean safe water and the preservation of our natural resources. With the implementation of the Surface Watershed Protection Program, New Brunswickers are in the business of protecting the future! In fact, good land use practices required in the Watercourse Setback Designation will help to protect not only the surface watersheds, but the water supplies of people who depend upon groundwater or springs.

What is permitted within a protected area (setback zone) ?

As long as all existing applicable municipal, provincial and federal laws are adhered to, proper permits are obtained, care and concern for the watershed water quality are exercised and no contaminant is added to any watercourse, a municipality, person or corporate body may do the following within a **protected area (setback zone)** (All other developments and activities are prohibited):

(a) enjoy access for primitive recreational uses:

These include such things as study of wildlife, hunting, fishing, trapping, canoe portaging, cross-country skiing and snow-shoeing. Harvesting of wild crops by non-motorized mechanical means, is also permitted;

(b) operate a motorized vehicle on provincial highways existing as of November 8, 1990;

(c) survey and post signs;

(d) carry out emergency operations conducted for the public health, safety or general welfare; Included are natural resource protection, law enforcement and search and rescue operations;

(e) rebuild, maintain, renovate or make additions to existing single-family and existing multiple-family dwellings:

However, such residences must have on-site sewage disposal facilities that meet the requirements of the Department of Health and Community Services. Existing residential buildings **cannot be converted to increase the number of family units.** Where an existing dwelling has been damaged or destroyed it may be rebuilt, after notifying the Minister, as long as it is no closer to the watercourse than the existing dwelling was and no additional buildings are built. Measures to prevent the discharge of sediments into the watercourse must be undertaken.

Routine residential property maintenance may be carried out. Additional landscaping may also be carried out provided that the landscaping is at least 5 metres (16 ft) from the banks of the watercourse and no trees are cut within 15 metres (50 ft) from the banks of the watercourse. Landscaping does not include major structures such as garages, swimming pools and ponds. Maintenance or upgrading of existing septic systems is also permitted.

(f) on residential properties only, remove dead and blown down trees within 15 metres (50 ft) of the banks of a watercourse;

(f.1) within 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out tree planting activities between 30 and 75 metres (100 and 250 ft) from the banks of the watercourse;

(f.2) at a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out tree planting activities between 15 and 75 metres (50 and 250 ft) from the banks of the watercourse;

(g) within 1 kilometre (0.6 mi) upstream of a surface water supply intake, selection cut by mechanical or by non-mechanical means between 30 and 75 metres (100 and 250 ft) from the banks of a watercourse:

Cutting within this zone must only occur from January 1 to March 31 of each year south of the Village of Bath; and only from November 1 to March 31 of the following year north of the Village of Bath. During any five year period, no more than 30 percent of the stems, or up to 30 percent of the volume, may be removed on any one property within the protected area;

(g.1) at a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, selection cut by mechanical or non-mechanical means between 15 and 75 metres (50 and 250 ft) of a watercourse:

Cutting within this zone must only occur from January 1 to March 31 of each year south of the Village of Bath; and only from November 1 to March 31 of the following year north of the Village of Bath. During any five year period, no more than 30 percent of the stems, or up to 30 percent of the volume, may be removed on any one property OR the volume of trees cut is cut in accordance with a forest management plan prepared by a Registered Professional Forester.

"selection cut" means a method of cutting trees such that:

(a) a well-distributed stand of trees and other vegetation is maintained,

(b) the trees cut are limited to 10 centimetres (4 in) or more in diameter at 1.36 metres (4.5 ft) above ground level, and

(c) no openings greater than 300 square metres (359 yds^2) are created in the forest canopy.

(h) within 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out existing agricultural activities between 30 and 75 metres (100 and 250 ft) from the banks of a watercourse:

Within this zone, plowing or tilling must be contoured across the slope, and cannot occur on slopes greater than 5 horizontal to 1 vertical, without construction of diversion terraces. Surface runoff from each field must not flow directly into the watercourse. Fields used for livestock grazing must have a suitable fence constructed, in order to keep livestock at least 30 metres (100 ft) from the watercourse. Green manuring or incorporation of green plant material, other than the primary crop, into the soil, is also required within the zone, in addition to inorganic fertilizing;

(h.1) at a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out existing agricultural activities between 15 and 75 metres (50 and 250 ft) from the banks of a watercourse:

Within this zone, plowing or tilling must be contoured across the slope, and cannot occur on slopes greater than 5 horizontal to 1 vertical, without construction of diversion terraces. Surface runoff from each field must not flow directly into the watercourse. Fields used for livestock grazing must have a suitable fence constructed, in order to keep livestock at least 15 metres (50 ft) from the watercourse. Green manuring or incorporation of green plant material, other than the primary crop, into the soil, is also required within the zone, in addition to inorganic fertilizing;

(h.2) at a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, hay removal is permitted up to 5 metres (16 ft) from the banks of a watercourse;

(i) within 1 kilometre (0.6 mi) upstream of a surface water supply intake, spray pesticides between 30 and 75 metres (100 and 250 ft) of a watercourse:

Any person who sprays pesticides within this area must hold a Class B Level 4 or other appropriate certification under the Pesticides Control Act;

(i.1) at a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, spray pesticides between 15 and 75 metres (50 and 250 ft) from the banks of a watercourses:

Any person who sprays pesticides within this area must hold a Class B Level 4 or other appropriate certification under the Pesticides Control Act;

(j) construct roads at approved watercourse crossings provided that guidelines as specified in the Watercourse Setback Designation are followed:

These guidelines help prevent the direct discharge of sediment into a watercourse by specific construction methods designed to minimize ground disturbance and prevent erosion;

An approved watercourse crossing is a watercourse crossing which has been approved by the Minister of the Environment under the Watercourse Alteration Regulation;

(k) install and operate electrical pump stations, provided that they conform to the standards specified in the Watercourse Setback Designation;

(l) install and operate fuel powered pumps, provided that they conform to the standards specified in the Watercourse Setback Designation, only between 30 and 75 metres (100 and 275 ft) of the banks of a watercourse;

(m) undertake **underground** exploration/development work or mineral extraction if the work is at sufficient depth not to influence the watercourse;

(n) drive motorized recreational vehicles at approved watercourse crossings;

(o) use existing public beaches:

This includes beaches on both public and/or private land on which the general public have access for the purpose of swimming;

(p) use existing public boat launching areas;

(q) construct and operate substations, terminal stations and any part of a transmission line at approved watercourse crossings;

(r) undertake sugar bush operations:

However, no mechanical equipment or sap processing may occur within 30 metres (100 ft) of the watercourse;

(r.1) conduct watercourse bank protection activities in accordance with a permit issued under the Watercourse Alteration Regulation;

(s) undertake certain **surface** mineral exploration activities, including establishing grid lines, prospecting, surveying, surveys and mapping;

(t) construct and operate the intake structure and conveyance works associated with a commercial aquaculture facility.

Are all the springs, streams, rivers, lakes, etc. on my property considered to be "watercourses"?

Watercourses include lakes, rivers, and most streams within the watershed. However, some very small, seasonal brooks, ditches, and wet areas **may not** be included. Under the Watercourse Setback Designation, the 75 metre (250 ft) setback applies only to watercourses which are specifically identified on plans contained in the general register of **protected areas (setback zone)** maintained in the office of the Minister of the Environment. Copies of these maps can also be viewed and purchased at regional New Brunswick Geographic Information Corporation Offices (Land Information Centres). These maps can also be viewed at other locations in the province, including regional offices of the Departments of Agriculture, Natural Resources and Energy and Health and Community Services.

How do I find out whether my property is affected and which watercourses are included in the Watercourse Setback Designation?

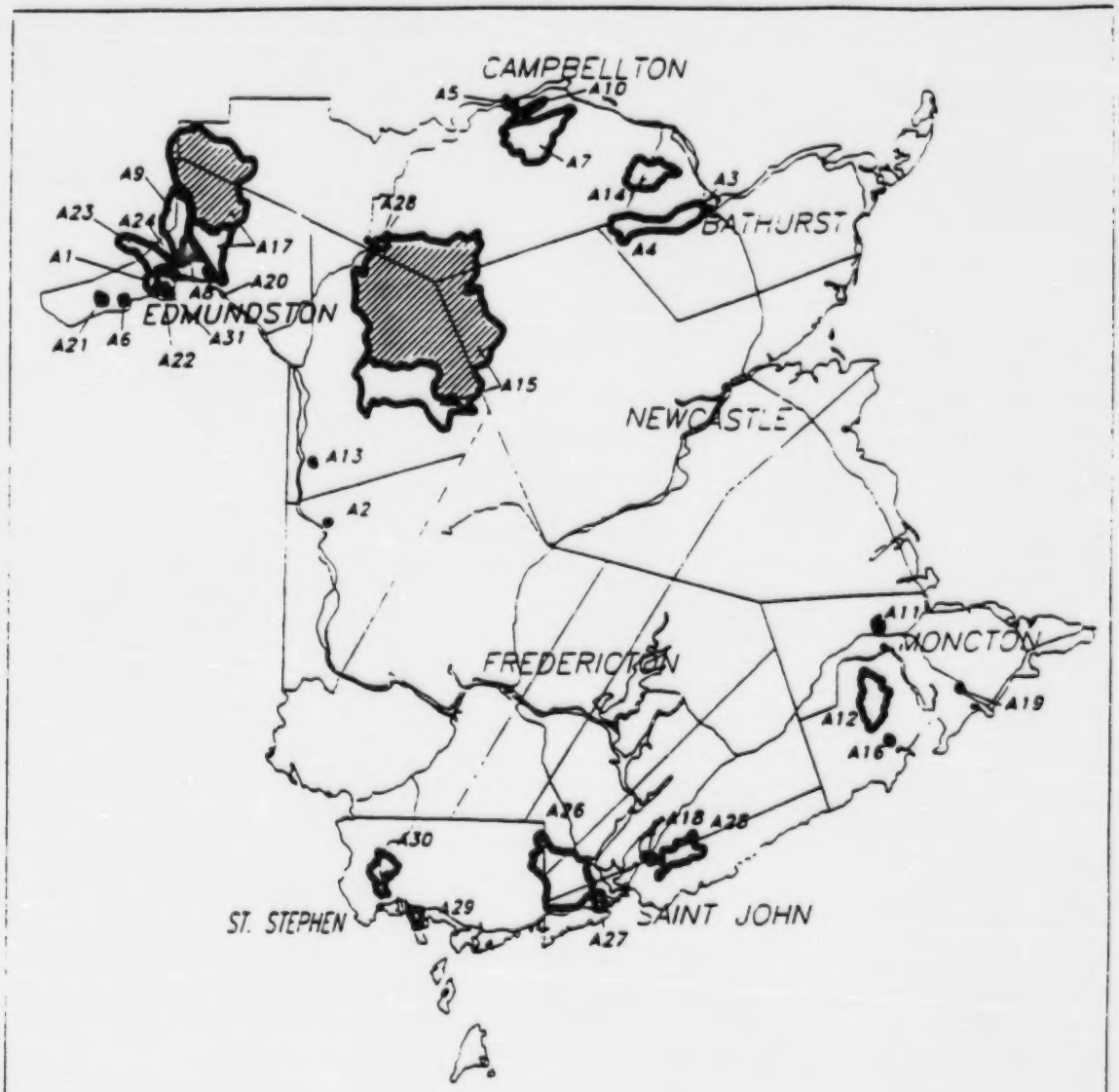
In order to find out whether or not your property is affected by the Watercourse Setback Designation, first check to see if your property is contained within any of the designated watersheds listed below (Figure A2). If you think your property may be one of those affected, contact the Department of the Environment or the Geographic Information Corporation Office (Land Information Centre) nearest you, to obtain maps showing the designated watersheds and selected watercourses. By checking these maps, you will be able to tell if your property is affected and which streams or other watercourses on your property are affected by the Watercourse Setback Designation.

What happens if I am unable to comply with the Watercourse Setback Designation?

There will, of course, be developments or activities **presently existing** within the 75 metre (250 ft) setbacks which will not conform with the conditions of the Watercourse Setback Designation. The Minister of the Environment has three options in addressing these situations:

1) to grant exemptions with specific conditions;
2) to refuse a request for an exemption; or
3) to acquire all or a portion of the land.

If you own or are developing, constructing, operating or maintaining, within a **protected area (setback zone)**, an activity or thing which is prohibited, controlled, limited or otherwise affected by the Watercourse Setback Designation, and you feel that you are unable to comply with the requirements of the Watercourse Setback Designation, you must request an exemption from the Minister of the Environment, in writing. A form for this request is included in this package for your convenience.



N.B. SURFACE WATER SUPPLY WATERSHEDS
BASSIN HYDROGRAPHIQUES D'APPROVISIONNEMENT EN EAUX DE SURFACE DU N.-B.

REFERENCE-LEGENDE

WATERSHED.. BASSIN HYDROGRAPHIQUE

UNDEVELOPED PORTION OF WATERSHED — SECTEUR NON-DESSERVI DU BASSIN HYDROGRAPHIQUE

WATERSHED No. - A 15 No DE BASSIN HYDROGRAPHIQUE

COUNTY BOUNDARY.. — LIMITE DE COMTÉ
N.B. HIGHWAYS.. — ROUTE
CITY/TOWN/VILLAGE.. • CITÉ/VILLE/VILLAGE

New Nouveau Brunswick

ENVIRONMENTAL PLANNING AND SCIENCES BRANCH/
DIRECTION DE LA PLANIFICATION ET DES SCIENCES DE L'ENVIRONNEMENT
DEPARTMENT OF THE ENVIRONMENT/MINISTÈRE DE L'ENVIRONNEMENT
PROVINCE OF NEW BRUNSWICK/PROVINCE DU NOUVEAU-BRUNSWICK

MUNICIPALITY		WATERSHED	MUNICIPALITY		WATERSHED
Baker Brook	A1	Ruisseau a Zepherin Watershed	Riviere Verte	A17	Downstream of mouth of Little Forks Br
Bath	A2	Unnamed tributary to Saint John R	Rothesay	A18	Carpenter Pond Watershed
Bathurst	A3	Carters Brook Watershed	Sackville	A19	Ogden Mill Brook Watershed
	A4	Miggie River Watershed	Saint-Basile	A20	Unnamed tributary Ruisseau Des Smith
Campbellton	A5	Prichard L.-Smith L. Watershed	St. F. de-Madawaska	A21	Unnamed tributary to Saint John R.
Clair	A6	Ruisseau Thompson Watershed	Saint-Hilaire	A22	Ruisseau a Fern-Horton Watershed
Dalhousie	A7	Charlo River Watershed	Saint-Jacques	A23	Riviere a la Truite Watershed
Edmundston	A8	Ruisseau a Blanchette Watershed		A24	Unnamed tributary to Madawaska R.
	A9	Riviere Iroquois Watershed	Saint John	A25	Loch Lomond Watershed
Eel River Crossing	A10	Eel River Watershed		A26	East and West Musquash Watershed
Moncton	A11	Turtle Creek Watershed		A27	Spruce Lake Watershed
	A12	McLaughlan Rd. Reservoir Watershed	Saint-Quentin	A28	Five Fingers Brook Watershed
Perth-Andover	A13	Hugs Brook Watershed	St. Andrews	A29	Chamcook Lake Watershed
Petit-Rocher	A14	Nigogoo River Watershed	St. Stephen	A30	Dennis Stream Watershed
Plaster Rock	A15	Downstream of the Mouth of Two Bay	Verret	A31	Ruisseau Trois-Saules Watershed
Riverside-Albert	A16	Arcadian Vault Brook Watershed			

Figure (A2). Watersheds designated under the Surface Watershed Protection Program.

LIST OF DESIGNATED WATERSHEDS

Municipality		Watershed
Baker Brook	A1	Ruisseau à Zépherin Watershed
Bath	A2	Watershed Of Unnamed Tributary To Saint John R.
Bathurst	A3 A4	Carters Brook Watershed Middle River Watershed
Campbellton	A5	Prichard Lake - Smith Lake Watershed
Clair	A6	Ruisseau Thompson Watershed
Dalhousie	A7	Charlo River Watershed
Edmundston	A8 A9	Ruisseau à Blanchette Watershed Rivière Iroquois Watershed
Eel River Crossing	A10	Eel River Watershed
Moncton	A11 A12	Turtle Creek Watershed McLaughlin Road Reservoir Watershed
Perth-Andover	A13	Huds Brook Watershed
Petit-Rocher	A14	Nigadoo River Watershed
Plaster Rock	A15	Tobique River Watershed downstream of the mouth of Two Brooks
Riverside-Albert	A16	Arabian Vault Brook Watershed
Rivière Verte	A17	Green River Watershed downstream of the mouth of Little Forks Branch Green River
Rothesay	A18	Carpenter Pond Watershed
Sackville	A19	Ogden Mill Brook Watershed
Saint-Basile	A20	Watershed of Unnamed Tributary To Ruisseau Des Smyth
Saint-François-de-Madawaska	A21	Watershed of Unnamed Tributary to Saint John R.
Saint-Hilaire	A22	Ruisseau à Félix-Martin Watershed
Saint-Jacques	A23 A24	Rivière à la Truite Watershed Watershed of Unnamed Tributary to Madawaska R.
Saint John	A25 A26 A27	Loch Lomond Watershed East and West Musquash Watershed Spruce Lake Watershed
Saint-Quentin	A28	Five Fingers Brook Watershed
St. Andrews	A29	Chamcook Lake Watershed
St. Stephen	A30	Dennis Stream Watershed
Verret	A31	Ruisseau Trois-Milles Watershed

Watercourse Setback Designation Order

1. In this Schedule:

"act of God" means an extraordinary occurrence or circumstance that is directly and exclusively due to natural causes without human intervention, which could not by any amount of ability have been foreseen or, if foreseen, could not by any amount of human care and skill have been resisted;

"agricultural activity" means an activity which uses land for the purpose of producing crops or raising livestock and includes operating a plant nursery, greenhouse, riding school, riding stable, commercial dog kennel and sod farming;

"approved watercourse crossing" means a watercourse crossing which has been approved by the Minister of the Environment under the Watercourse Alteration Regulation;

"distribution system" means works that convey or is able to convey water from the watercourse to the users including the intake structure, pipes, man-made storage reservoirs, pumping stations, fire hydrants, service connections and the associated valves;

"dwelling unit" means a room or suite of two or more rooms designed or intended for use by an individual or family, in which culinary facilities and sanitary conveniences are provided for the exclusive use of such individual or family;

"green manuring" means incorporation of plant material, other than the primary crop, into the soil, while green or soon after maturity, for the purposes of improving the soil.

"landscaping" means the alteration of existing ground conditions together with the construction of ground features and includes minor structures, but excludes major structures such as garages, swimming pools and ponds;

"mineral extraction" means the extraction of any natural, solid, inorganic or fossilized organic substance, but does not include:

(a) sand, gravel, clay, or soil unless it is to be used for its chemical or special physical properties, or both or where it is taken for contained minerals;

(b) ordinary stone used for building or construction;

"mineral processing" means the dry and wet crushing of ore or other mineral bearing product in order to concentrate the grade of ore;

"multiple-family dwelling" means a dwelling containing more than one dwelling unit;

"public beaches" means public and/or private land on which the general public have access for the purpose of swimming;

"public boat launching areas" means public and/or private land on which the general public have access for the purpose of launching boats;

"riprap" means clean, inorganic, non-ore-bearing, non-toxic, angular, durable, quarried or field rock obtained from a non-watercourse source with at least 60 percent of the rock 0.03 m^3 (1.2 in^3) or larger;

"road" means any road or street constructed in order to carry out permitted activities within the Protected Area as defined under this Order;

"selection cut" means a method of cutting trees such that

(a) a well-distributed stand of trees and other vegetation is maintained,
(b) the trees cut are limited to 10 centimetres (4 in) or more in diameter at 1.36 metres (4.5 ft) above ground level, and
(c) no openings greater than 300 square metres (359 yds^2) are created in the forest canopy;

"single-family dwelling" means a dwelling containing only one dwelling unit;

"surface mineral exploration work" means original exploration and development and includes:

(a) establishing grid lines;
(b) general prospecting;
(c) geological, geophysical and geochemical surveying;
(d) drilling where core or cuttings are taken and logged or analyzed;
(e) trenching where the ore-body is exposed but no bulk sample taken;
(f) geophysical logging of drill holes;
(g) logging of drill core or cuttings;
(h) boundary or control surveys and topographic mapping;

"underground exploration/development work" means all non-production work required to investigate and develop an ore-body not considered as surface mineral exploration/development work as defined in this Order;

"underground storage tank" means a storage tank that has ten percent or more of its volume, including the volume of attached underground piping, below adjacent ground level;

2. All uses of land, developments, activities, or things not permitted herein are prohibited within a Protected Area.

3. Within a Protected Area, the maintenance, development or expansion of a municipal distribution system shall be carried out provided the proper permits are obtained and care and concern for the watershed water quality is exercised.

4. Within a Protected Area, a person or body corporate may do the following, provided no contaminant is added to any watercourse and all existing applicable municipal, provincial and federal laws are adhered to:

(A) Enjoy access for primitive recreational uses including but not limited to fishing, hiking, hunting, wildlife study, wild crop harvesting by non-motorized mechanical means, trapping, canoe portaging, cross-country skiing and snow-shoeing;

(B) Operate a motorized vehicle on provincial highways existing on the date of commencement of this Order;

(C) Undertake surveying and sign posting;

(D) Carry out emergency operations conducted for the public health, safety or general welfare such as natural resource protection, law enforcement and search and rescue operations;

(E) Maintain, renovate or make additions to existing single-family and multiple-family dwellings that have on-site sewage disposal facilities that meet the requirements of the General Regulation - Health Act provided that

(i) All existing residential buildings are not further converted to multiple-family dwellings or apartments;

(ii) All existing multiple-family units are not further converted such that the number of family units is increased;

(iii) Measures are taken to prevent the discharge or loss of sediments into the watercourse by:

(a) Installing a sediment control device between the construction site and the watercourse before construction,

(b) Storing fill material near the 75 metre (250 ft) line or at a greater distance if practical, and

(c) Stabilizing exposed soil within 60 days after the beginning of construction;

(E.1) After notification to the Minister, rebuild a single-family or multiple-family dwelling that has been damaged or destroyed provided that it is no closer to the watercourse than the original dwelling and the requirements of subparagraph (E)(iii) are met;

(E.2) On properties containing a single-family or multiple-family dwelling,

(i) Maintain or upgrade the existing septic system,

(ii) Carry out routine residential property maintenance, and

(iii) Carry out additional landscaping provided that the landscaping is at least 5 metres (16 ft) from the banks of the watercourse and no trees are cut within 15 metres (50 ft) from the banks of the watercourse;

(F) Remove dead and blown down trees within 15 metres (50 ft) of the banks of a watercourse only on residential properties containing an existing single-family or existing multiple-family dwelling;

(F.1) Within 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out tree planting activities between 30 and 75 metres (100 and 250 ft) from the banks of the watercourse;

(F.2) At a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out tree planting activities between 15 and 75 metres (50 and 250 ft) from the banks of the watercourse;

(G) Within 1 kilometre (0.6 mi) upstream of a surface water supply intake, selection cut by mechanical or non-mechanical means between 30 and 75 metres (100 and 250 ft) from the banks of a watercourse provided that;

(i) No more than 30 percent of the stems, up to 30 percent of the volume, on any one property within a Protected Area are cut;

(ii) Any property mentioned in G(i) above shall only be cut once every five years;

(iii) Cutting occurs only from November 1 to March 31, inclusive, of the following year north of 46 degrees N. latitude, excluding the Village of Perth-Andover and the Village of Bath;

(iv) Cutting occurs only from January 1 to March 31, inclusive, of each year south of 46 degrees N. latitude, including the Village of Perth-Andover and the Village of Bath;

(G.1) At a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, selection cut by mechanical or non-mechanical means between 15 and 75 metres (50 and 250 ft) of a watercourse provided that

(i) No more than 30 per cent of the stems, up to 30 percent of the volume of trees, on any one property is cut once every five years or the volume of trees cut is cut in accordance with a forest management plan prepared by a Registered Professional Forester as defined in The New Brunswick Foresters Act, 1958;

(ii) Cutting occurs only from November 1 to March 31, inclusive, of the following year north of 46 degrees N. latitude, excluding the Village of Perth-Andover and the Village of Bath;

(iii) Cutting occurs only from January 1 to March 31, inclusive, of each year south of 46 degrees N. latitude, including the Villages of Perth-Andover and Bath;

(H) Within 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out existing agricultural activities between 30 and 75 metres (100 and 250 ft) from the banks of those watercourses identified on plans A1 to A31 inclusive provided that:

(i) Plowing or tilling is contoured across the slope;

(ii) Plowing or tilling shall not occur on slopes greater than 5 horizontal to 1 vertical, without diversion terraces as specified in Implementation Guidelines for Cooperation Agreement Canada-New Brunswick on Agricultural Food Development;

(iii) Surface runoff from each field does not flow directly into the watercourse;

(iv) Fields utilized for livestock grazing shall have a suitable fence constructed along the periphery of the 30 metres (100 ft) in order to allow the livestock no closer than 30 metres (100 ft) to the watercourse;

(v) The practise of green manuring shall be required in addition to inorganic fertilizing;

(H.1) At a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, carry out existing agricultural activities between 15 and 75 metres (50 and 250 ft) from the banks of those watercourses identified on plans A1 to A31 inclusive, provided that:

(i) The requirements of subparagraphs (H)(i), (ii), (iii) and (v) are met;

(ii) Fields utilized for livestock grazing have a suitable fence constructed along the periphery of the 15 metres (50 ft) in order to allow the livestock no closer than 15 metres (50 ft) to the watercourse;

(H.2) Notwithstanding paragraph (H.1), at a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, hay removal is permitted up to 5 metres (16 ft) from the banks of a watercourse;

(I) Within 1 kilometre (0.6 mi) upstream of a surface water supply intake, spray pesticides between 30 and 75 metres (100 and 250 ft) from the banks of those watercourses identified on plans A1 to A31 inclusive provided that:

(i) Any person who sprays pesticides within this area holds a Class B Level 4 or other appropriate certification under the Pesticides Control Act;

(I.1) At a distance greater than 1 kilometre (0.6 mi) upstream of a surface water supply intake, spray pesticides between 15 and 75 metres (50 and 250 ft) from the banks of those watercourses identified on plans A1 to A31 inclusive provided that any person who sprays pesticides within the area holds a Class B Level 4 certificate or other appropriate certification under the Pesticides Control Act;

(J) Construct roads at approved watercourse crossings provided that:

(i) Off-take ditches shall be constructed to help prevent the direct discharge of sediment into a watercourse;

(ii) Off-take ditches or water diversion bars shall be constructed along the ditch of the road at spacings determined by dividing 500 metres (1640 ft) by the road grade (in percent);

(iii) For every hectare of exposed construction area, sediment basins or traps having a minimum storage volume of 190 cubic metres (248 yds^3) shall be constructed to intercept overland flow;

(iv) Sediment traps shall be maintained in the ditches until grading and stabilization of the entire construction site is completed;

(v) All exposed bank material shall be immediately stabilized to reduce siltation of the watercourse through the use of vegetation and/or riprap;

(vi) All road surfaces shall have a minimum shoulder to shoulder width of 5.5 metres (18.0 ft) with the exception of a logging road and a residential driveway to a single family dwelling which shall have a minimum shoulder to shoulder width of 3.5 metres (11.5 ft);

(vii) The roadbed of all roads, except logging roads, shall be surfaced with clean, good draining, coarse granular material, asphalt or chip-seal ;

(viii) Water bars shall be installed across all roads which are no longer used. They shall extend at least 300 millimetres (12 in) above the road surface and 300 millimetres (12 in) below the road surface and spaced as follows:

(a) 1 - 2 % slope, every 75 metres (250 ft);
(b) 3 - 5 % slope, every 50 metres (164 ft);
(c) 6 - 10 % slope, every 30 metres (100 ft);
(d) 11 - 15 % slope, every 20 metres (66 ft); and
(e) Greater than 15 % slope, every 15 metres (50 ft);

(ix) Borrow pits and topsoil disposal piles shall not be located within the Protected Area;

(x) All rights-of-way, landing areas and borrow pit locations shall be pre-cut. Standing trees shall not be bulldozed;

(xi) The ground shall not be disturbed within 75 metres (250 ft) of an approved watercourse crossing until the start of the bridge or culvert installation and equipment activity near watercourses shall be kept to a minimum;

(xii) Hillside cuts shall be kept to a minimum on slopes containing loose material, and shall not exceed slopes of 2 horizontal to 1 vertical in unstable areas;

(xiii) Unstable areas shall be filled with gravel, rock, or other suitable material to prevent erosion;

(xiv) Ditch run-outs shall be constructed so that flow will be effectively dissipated and not cause erosion away from the road;

(xv) Ditches shall not be constructed to empty **directly** into a watercourse;

(xvi) Roadbed culverts shall be installed at proper elevations and slopes in order to prevent ponding of water or erosion;

(xvii) The minimum size circular corrugated steel pipe required for a particular drainage area shall be as follows:

(a) With a drainage area of less than or equal to 50 ha (123 ac), the minimum size culvert shall be 750 mm (30 in);

(b) With a drainage area of greater than 50 ha (123 ac) but less than or equal to 80 ha (198 ac), the minimum size culvert shall be 900 mm (35 in);

(c) With a drainage area of greater than 80 ha (198 ac) but less than or equal to 100 ha (247 ac), the minimum size culvert shall be 1000 mm (39 in);

(d) With a drainage area of greater than 100 ha (247 ac) but less than or equal to 170 ha (420 ac), the minimum size culvert shall be 1200 mm (47 in);

(e) With a drainage area of greater than 170 ha (420 ac) but less than or equal to 240 ha (593 ac), the minimum size culvert shall be 1400 mm (55 in);

(f) With a drainage area of greater than 240 ha (593 ac) but less than or equal to 350 ha (865 ac), the minimum size culvert shall be 1600 mm (63 in);

(g) With a drainage area of greater than 350 ha (865 ac) but less than or equal to 475 ha (1 174 ac), the minimum size culvert shall be 1800 mm (71 in);

(h) With a drainage area of greater than 475 ha (1 174 ac) but less than or equal to 600 ha (1 483 ac), the minimum size culvert shall be 2000 mm (79 in);

(xviii) All debris and excavated material shall be removed from the watercourse and adjacent areas and disposed of, or placed in a manner where it cannot be returned to the watercourse;

(xix) All necessary precautions shall be taken to prevent discharge or loss of any contaminant;

(xx) The slope of the culvert structure shall be 0.5 percent or less. In cases where the stream gradient does not allow for this requirement then pipe arches, interior baffling, or stilling basins shall be used to maintain adequate depth of flow and velocity for fish passage;

(xxi) The invert of the culvert structure shall be set a minimum of 150 millimetres (6 in) below the original channel bottom level, except in multiple culvert installation;

(xxii) Multiple culvert installations shall be restricted to two culverts in a natural stream channel;

(xxiii) Multiple culverts shall be placed a distance of one-half the diameter or span apart, or 1 metre (3.3 ft), whichever is greater. The bottom of one culvert shall be set 150 millimetres (6 in) below the original channel bottom level, with the second culvert set at an elevation equal to the original stream bed;

(xxiv) Riprap shall be placed at both ends of the culvert up to one-half a pipe diameter or a maximum of 0.5 metres (1.6 ft) above the top of the pipe and a minimum of one pipe diameter on each side;

(xxv) The final grade of the road crossing shall be at least one-half pipe diameter higher than the top of the culvert;

(K) Install and operate electrical pump stations, provided that they conform to the following standards:

(i) Be equipped with a CSA approved device to prevent backflow;

(ii) The intake pipes shall be located a minimum of 100 metres (328 ft) downstream or 500 metres (1640 ft) upstream of the municipal water supply intake and shall not disturb the bed or banks of the watercourse;

(iii) The intake pipes at the pumping stations shall be screened at the inlet;

(iv) An open area of 0.19 square metres (2.0 ft^2) of screen shall be provided for each 0.028 m^3/sec (1.0 ft^3/sec) of water being withdrawn;

(v) The screen shall not have openings larger than 57 square millimetres (7.5 mm by 7.5 mm or 0.3 in by 0.3 in); and

(vi) The maximum water withdrawal rate from the watercourse shall ensure that a maintenance flow of not less than 25 percent of the mean monthly flow be maintained in the watercourse at all times;

(L) Install and operate gasoline powered pumps between 30 and 75 metres (100 and 250 ft) from the banks of a watercourse, provided that they conform to (K) (i) through (K) (vi), above;

(M) Undertake underground exploration/development work or mineral extraction where it can be shown that the underground exploration/development work or mineral extraction is at sufficient depth not to influence the watercourse;

(N) Drive motorized recreational vehicles at approved watercourse crossings;

(O) Utilize existing public beaches;

(P) Utilize existing public boat launching areas;

(Q) Construct and operate substations, terminal stations and any part of a transmission line at approved watercourse crossings;

(R) Undertake a sugar bush operation provided that no mechanical equipment or sap processing occurs within 30 metres (100 ft) of the watercourse;

(R.1) Conduct watercourse bank protection activities subject to the requirements of the Watercourse Alteration Regulation - Clean Water Act;

(S) Undertake the following surface mineral exploration activities:

(i) establishing grid lines;

(ii) general prospecting;

(iii) geological, geophysical and geochemical surveying;

(iv) boundary or control surveys and topographic mapping; and

(T) Construct and operate the intake structure and conveyance works associated with a commercial aquaculture facility provided the proper permits are obtained and care and concern for the watershed water quality is exercised.

APPLICATION FOR AN EXEMPTION TO THE WATERCOURSE SETBACK DESIGNATION ORDER

NAME OF APPLICANT: _____	PROPERTY LOCATION AND IDENTIFICATION
Mailing Address: _____ _____ _____	Watershed: _____ Watercourse: _____ P.I.D. #: _____ Parish: _____ County: _____
Telephone Number Home: _____ **Bus:** _____ **Fax:** _____	Watershed: _____ Watercourse: _____ P.I.D. #: _____ Parish: _____ County: _____
OWNER OF PROPERTY: _____	Watershed: _____ Watercourse: _____ P.I.D. #: _____ Parish: _____ County: _____
(If different than above) **Mailing Address:** _____ _____ _____	
Telephone Number: Home: _____ **Bus:** _____ **Fax:** _____	**(A map must be included for each property)**

Your Property Identification Number (P.I.D. may be determined by referring to your property tax bill.

TYPE OF ACTIVITY

Residential ___ Commercial ___ Agriculture ___ Forestry ___ Other ___

DESCRIPTION OF ACTIVITY

(State whether activity is existing or proposed; specify the distance from the watercourse that the activity will take place; include a separate description for each property. Use additional paper as needed.)

_____

_____

_____

_____

DESCRIPTION OF ACTIVITY (cont'd)

HAVE YOU PREVIOUSLY REQUESTED AN EXEMPTION FROM THE MINISTER?

(If so please quote the reference number) _____

I HEREBY CERTIFY THAT THE ABOVE INFORMATION IS CORRECT TO THE BEST OF MY KNOWLEDGE

Applicant Signature: _____ Date: _____

FILE NO.: _____

For NBDOE use only

Watershed Maps may be consulted at Department of Environment offices, and the New Brunswick Geographic Information Corporation (NBGIC)

Appendix E

Guidelines for Seeding Roadbeds and Road Banks

by Clinton Maclean
NB Department of Agriculture

The main constraints in establishing ground cover under New Brunswick conditions are:

1. Soil acidity - Many of our soils are naturally more acidic than those of other regions.

2. Soil fertility - The inherent fertility of most of our wooded areas is rather low. Phosphorus levels are especially critical for root development and seedling vigour. A soil test should be taken for each site to determine lime and fertilizer requirements.

3. Winter hardiness - Given our severe winters, certain species or varieties used in other areas may not survive here. Snow cover is very important. Windswept areas or bare knolls are especially susceptible.

4. Adaptation of species - Certain species, such as birdsfoot trefoil, are usually quite difficult to establish in New Brunswick. It may be suitable in certain situations, but should not be a major component of a standard mixture.

5. Control of Runoff - It is essential to control runoff until adequate ground cover can be established. Measures such as water diversion and mulching with hay may be necessary in certain situations.

Recommendations

1. Lime and fertilizer - A soil sample for each site should be submitted to the Provincial Soils Laboratory for analysis. General recommendations for lime and fertilizer are as follows:

   Establishment Year

   Lime - 6.7 tonnes per ha (3 tons per acre)

   Fertilizer - 560 kg per ha (500 lbs/acre) 10-20-20-.1 Boron

   These recommendations may vary considerably, and a soil test may provide significant cost savings. Recommendations for subsequent years will be based on the soil test results and the actual composition of the established stand.

2. Mixtures - Forage mixtures for erosion control should consist of both grasses and legumes. Legumes help provide nitrogen to the stand, and require that the seed be inoculated with the proper strain of bacteria.

A general recommendation for an all purpose mixture follows.

Species	Percent
Creeping red fescue	30
Canada bluegrass	15
Tall fescue	15
Timothy	12
Perennial Ryegrass	10
Annual Ryegrass	4
Alsike clover	10
White clover	4

Other species that may be suitable under certain conditions include hard fescue, reed canarygrass, creeping foxtail, red clover, sweet clover, and birdsfoot trefoil.

3. Seeding - Successful establishments depends more on seedbed preparation than the actual amount of seed used. Since an ideal seedbed will be difficult to prepare, high seeding rates should be used. Care should be taken not to leave the soil bare any longer than necessary. Seed should be broadcast at a rate of 100 kg/ha (89 lbs/ac) on loamy soils and 150 kg/ha (134 lbs/acre) on clay soils immediately after removal of vegetation. Covering seeds to a soil depth of 6 to 12 mm (¼ to ½ in) will greatly increase germination and emergence.

Appendix F

Determining Culvert Length

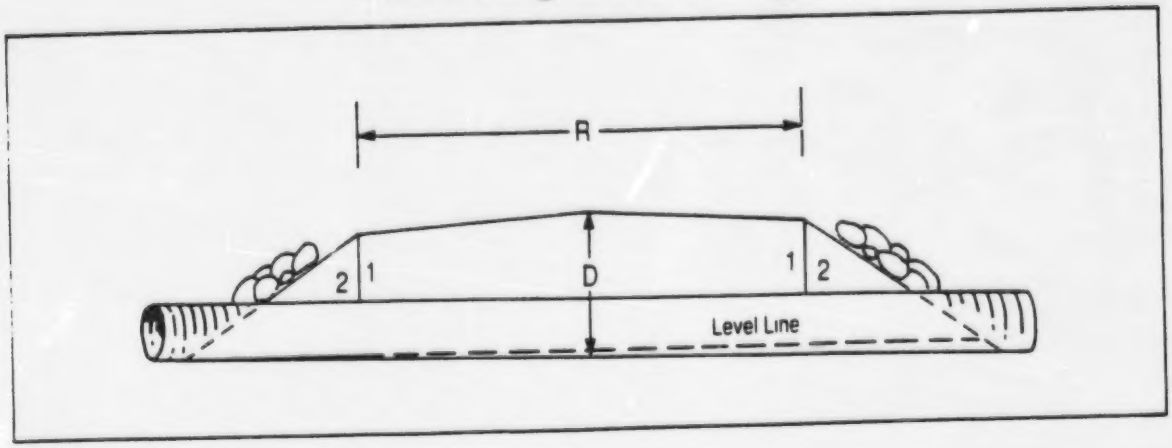


Figure (A3). Determining culvert length.

Culvert length, as shown in Figure A3, can be determined from the formula CL = R + 4D + 0.6 metres (CL = R + 4D + 2.0 ft) where:

CL = Culvert length (metres/ft)
R = Road width (metres/ft)
D = Road depth as measured from the bottom of the culvert to the road surface

Example

What culvert length is required for a stream crossing where the roadway width is 4.9 metres (16 ft), the culvert diameter is 0.9 metres (3 ft), and the amount of fill to be placed over the culvert is 0.6 metres (2 ft)? Note: The culvert is to be installed at a right angle to the road.

Answer

From the information provided, the roadway width or R is given as 4.9 metres (16 ft). If the culvert diameter is 0.9 metres (3 ft) and 0.6 metres (2 ft) of fill is to be placed over it, than D would equal the sum of these two values, or 1.5 metres (5 ft).
Using the given formula culvert length would equal:

CL = R + 4D + 0.6 m
= 4.9 m + 4 (1.5 m) + 0.6 m
= 11.5 m

or CL = R + 4D + 2.0 ft
= 16 ft + 4(5 ft) + 2.0 ft
= 38 ft

Appendix G

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Glossary

Abutment:	A wall or other structure which serves as the foundation of a bridge.
Ambient flow:	The total amount of water flowing past a specific point of a watercourse not affected by humans during a specified time.
Anti-seep collar:	A device, usually built of concrete, which provides a water-tight seal between sections of outlet pipe within a pond embankment.
Arch culvert:	A type of culvert which has an arch shape, open bottom, and rests on foundations usually made of concrete.
Average channel depth:	The average of the vertical distances from a straight perpendicular line between the normal high water marks of the channel to the bed of the watercourse.
Backfill:	Fill used to replace material removed during construction of a structure such as a bridge or culvert.
Backslope:	See "roadbed backslope".
Back timber:	A timber used in a box crib abutment which parallels the stream but is located on the side away from the stream.
Baffling:	A structure built or placed on the bed of a stream or culvert bottom, the purpose of which is to check or deflect stream flow.
Berm:	A wall of earth used to retain or redirect water flow.
Biocide:	Any chemical substance, such as a herbicide or pesticide, which is used to control living organisms.
Biochemical oxygen demand:	The quantity of oxygen consumed during a given period to produce oxidation of biodegradable organic matter present in water.
Borrow pit:	An area set aside specifically for the excavation of fill.
Box culvert:	A culvert, usually constructed of timber, which has square or rectangular ends.
Bridge:	A structure erected to span a watercourse which supports a foot path or roadway for people or land vehicle traffic. The distinction between bridges and culverts is made on the basis that the top of the bridge serves as the road surface whereas culverts are embedded in the road embankment.

Buffer strip: An area of undisturbed vegetation located alongside a watercourse.

Bypass pond: A pond connected to a watercourse by inlet and outlet pipes so as to obtain water from that watercourse.

Camber: To curve upward near the middle. Culverts are cambered so that upon settlement of the roadbed, they take on a more or less uniform slope.

Catchment area: The land area draining to a watercourse above a certain point along the watercourse.

Channel width: The straight line distance from the normal high water mark on one side of a watercourse to such mark on the opposite side of the channel.

Check dam: A dam used to slow the flow of water and reduce erosion potential.

Cofferdam: A water-tight enclosure built in a watercourse and pumped dry so that the foundations of a bridge or other structure can be constructed without causing siltation.

Conditions of approval: Conditions by which Watercourse Alteration Permits are issued for the purpose of altering a watercourse.

Contaminant: As defined in the Clean Water Act, means any solid, liquid, gas, micro-organism, odour, heat, sound, vibration, radiation, or combination of any of them present in the environment:

(a) that is foreign to, or in excess of, the natural constitutes of the environment;

(b) that effects the natural, physical, chemical, or biological quality or constitution of the environment;

(c) that endangers the health, safety, or comfort of a person or the health of animal life;

(d) that causes damage to property or to plant life or that interferes with visibility, the normal conduct of business or the normal enjoyment of life or use or enjoyment of property, or

(e) that is prescribed by regulation to be a contaminant, including pesticides.

Corewall: A trench dug lengthwise along the centre line of a pond's embankment which is filled and compacted with impervious material, such as clay, in order to prevent water seepage.

Cribbing: See "crib work".

Crib work:	Timber framing used as a retaining wall or support structure in the installation and construction of culverts and bridges.
Cross decking:	Timber placed across a bridge's stringers to hold them in place and to provide a base for the travel planking.
Cross drainage culvert	A culvert installed for the purpose of allowing runoff from the road right-of-way to pass under and away from a road.
Crossing:	Any project extending from one side to the opposite side of a watercourse, or to an island of upland within a protected natural resource, whether under, through, or over that resource. Such projects include, but are not limited to, roads, fords, bridges, culverts, utility lines, water lines, sewer lines and cables as well as maintenance work on these crossings.
Cross-sectional area of a watercourse:	An area determined by multiplying the channel width by the average channel depth.
Crown:	Slope given to a road surface which makes the centre of the road slightly higher than its sides, thus encouraging runoff to flow away from the road surface.
Culvert:	A conduit for conveying water through a roadway embankment.
Culvert invert:	The bottom half of a culvert.
Curb:	A length of sawn timber or pole placed along the outer edge of a bridge.
Dam:	Any man-made barrier, including appurtenant works and associated construction activities, which impound or divert water. Such activities include dredging or filling a watercourse in conjunction with dam construction or removal (i.e., coffer damming or altering an area downstream of a dam to facilitate, stabilize against, or channelize discharge from the dam and maintenance work on a dam and appurtenant works).
Debris:	Floating or sunken trash and dead or decaying vegetation.
Debris guard:	An open bottom cylindrical cover to a trickle tube which prevents it from becoming plugged with floating debris.
Department:	When used in conjunction with conditions relating to Provisional Permit, "Department" refers to the New Brunswick Department of the Environment.

Diversion: Rerouting a flowing watercourse to a location outside of its established channel.

Dredge: To move or remove by digging, scooping, or suctioning any sand, silt, mud, gravel, rock or other material from the bottom of a watercourse.

Dug-out pond: A type of pond which relies on surface runoff, ground water, or a combination of both as its primary source of water supply.

Edge of the bank of a watercourse: A break in slope created by the action of surface water and characterized by the lack of terrestrial vegetation.

Embankment pond: A pond built by constructing a dam, usually earthen, across a small valley or gully containing a water flow.

Emergency spillway: A broad, shallow depression in the embankment of a pond which serves as a back-up outlet in the event the regular outlet structure is not able to handle peak flood flows.

Enclosed spillway: A spillway structure which has a closed perimeter, such as a pipe.

Erosion control measures: Construction to lessen erosion of the banks of a watercourse.

Face timber: A timber used in a crib abutment which faces, and is parallel to, the stream.

Fill:
(1) (Verb) To put into or upon, supply to, or allow to enter, a watercourse, any earth, rock, gravel, sand, silt, clay, peat or debris.

(2) (Noun) Material other than structures placed in or adjacent to a watercourse.

Fill slope: The slope of fill around a structure such as the inlet and outlet ends of culverts, bridge abutments, etc.

Filter area: A forested or vegetated area into which silted water is diverted to filter out the silt before it can enter a watercourse.

Ford:
(1) (Verb) To cross a watercourse with wheeled or tracked machinery.

(2) (Noun) A permanent crossing of a watercourse which utilizes an area of existing non-erodible substrate such as ledge or cobble, or a location constructed by placing non-erodible material such as stone or geotextile on the bed of the watercourse.

Foreslope: See "roadbed foreslope".

Forest management activities:	Under the Provisional Permit System, forest management activities include timber stand improvement, timber harvesting, forest products harvesting, and regeneration of forest stands.
Freeboard:	The distance between the pond's normal water level and the top of the pond's embankment.
Groin:	A type of water diversion used to divert running water, such as that in a ditch, into a settling area. Groins are sometimes referred to as berms.
Grubbing:	The removal of stumps, slash, and other material unsuitable for use in roadbeds, embankments, etc.
Haunch:	The crevice formed along the length of a pipe culvert where it meets its bedding.
Head:	The height of water above a specific point of reference.
Headwall:	Vertical walls built at the inlet and outlet ends of a culvert which parallel the road and prevent soil from entering a watercourse or ditch.
Hydrocarbons:	Organic compounds containing carbon and hydrogen which occur in petroleum, natural gas, coal, etc. Hydrocarbons such as gas, oil, and grease are considered pollutants under the Watercourse Alteration Regulation.
Impoundment pond:	See "embankment pond".
Instream culvert:	A culvert installed in stream to allow water passage under the roadbed.
Instrument pools and wells:	Natural or artificial sites on watercourses where measurement devices may be used for hydrotechnical purposes, in sheltered or preferred conditions.
Lake:	Under the Provisional Permit System, a lake is any inland body of water which is naturally occurring and has a surface area in excess of 4 hectares (10 acres).
Land adjacent to a watercourse:	Any land area within 30 metres (100 ft), measured horizontally, of the normal high water line or upland edge of a watercourse.
Mechanical spillway:	A structure, usually made of concrete, plastic, metal, or some combination of these, designed to conduct water out of a pond without damaging its embankment.
Mulch:	A protective covering, such as hay, spread on the ground to prevent soil erosion.

Mud sills:	Timber or roundwood attached perpendicularly to the underside of a sill log(s) abutment for support in soft soil.
Normal high water line:	That line along the shore of a watercourse which is apparent from visible markings, changes in soil characteristics due to prolonged action of water, or from changes in vegetation, and which distinguishes between predominantly aquatic and predominantly terrestrial land. In the case of lakes and ponds, all land below the normal high water line is considered the bottom of the watercourse for the purposes of the Provisional Permit System.
Off-take ditch:	A ditch which drains water flowing down a roadside ditch into a settling area.
Open-bottomed culvert:	A culvert built so as to lack a solid bottom.
Open spillway;	A spillway that lacks a closed perimeter and is open to the atmosphere, such as a chute or concrete weir type.
Orthophoto map:	A map made by reproducing an assembly of photographs known as orthophotos. Orthophoto maps are generally printed with contour lines, place names, etc., to aid in their interpretation.
Outflow pipe:	A section of horizontal pipe which passes through a pond's embankment and is the means by which water is passed from one side of the pond to the other. Outflow pipes are normally used in combination with vertical pipes known as trickle tubes or overflow pipes.
Overflow channel:	A channel, usually earthen, built into a pond embankment to pass water to the other side.
Overflow pipe:	See "trickle tube".
Peak flow:	Period of greatest annual water flow by a watercourse.
Perennial watercourse:	A watercourse containing water year-round as depicted on the most recent edition of 1:50,000 series topographic maps. Such watercourses are depicted as solid, not broken lines.
Pesticide:	Any chemical preparation used to control unwanted plant or animal pests.
Pier:	An intermediate support such as for a bridge.
Pipe arch:	A type of culvert having a greater span than rise, the top being arch-shaped and the bottom being curved.

Pre-commercial thinning	A cutting operation undertaken in young stands not past the sapling stage of development for the purpose of improving the species composition, form, and growth rate of remaining trees.
Protected area:	Under the Surface Watershed Protection Program, it is the area within 75 metres (246 ft) measured horizontally from the bank of a designated watercourse. Within this area, land use activities are limited to protect the watercourse for use as drinking water.
Provisional Permit:	A special type of Watercourse Alteration Permit which gives the permittee permission to do certain types of "minor" watercourse alterations if their proposed activity meets prescribed conditions.
Push-off:	An area adjacent to a road into which stumps, slash, and other materials not suited for use in building the roadbed are deposited.
Recurrence interval:	The average time between occurrences of a flood of a given or greater magnitude.
Repair:	Any activity which extends below the normal high water line to fix or restore a structure that involves less than 50 percent of the structure.
Replacement:	Any activity which results in more than 50 percent of a structure being restored or reconstructed either above, or below, the normal high water line.
Restoration:	An activity returning a watercourse or structure from a disturbed or altered condition with lesser area or fewer functions to a previous condition with original area or functions.
Retaining wall:	A vertical structure generally constructed of wood, concrete or rock, or a combination of these materials and located at, or below, the normal high water line.
Riprap:	Heavy, irregular-shaped rocks which are placed so as to fit into each other, and stay in place, without the use of cementing agents.
Roadbed back slope:	The side of a ditch which faces towards the roadbed.
Roadbed foreslope:	The side of a ditch which is part of the roadbed.
Road dip:	A pronounced depression in a road or extraction trail.
Roadside ditch:	A ditch built adjacent to and parallel with a road.
Rock apron:	A layer of rock at the outlet of a culvert which prevents erosion due to scour.

Runoff: Water usually originating from melted snow or rain, that is not absorbed directly into deeper soil layers, but flows on top of, or near, the soil surface directly into a watercourse.

Saturated soils: A soil moisture content exceeding the field capacity and plastic limit of a particular soil. Field verification of this condition includes:

(1) squeezing a handful of soil and observing free water dripping from the sample;

(2) rolling out with the finger tips a lump of soil that forms a wire or rod 3 mm (0.1 in) in diameter that does not crumble when handled.

Scour: Erosion of a watercourse bottom and its sides caused by the action of ice and/or flowing water.

Scour depth: The depth to which a river or stream bottom is eroded by the action of ice and water flow.

Selection cutting: A harvest operation that involves the removal of individual trees or small groups of trees from an area at periodic intervals.

Shore: The narrow strip of land immediately bordering a body of water.

Shoreline: The common margin of dry land and a body of water.

Silt: A fine sediment consisting of particles less than 1/20th of a millimetre (1/100th of an inch) in diameter.

Siltation: The deposit of silt into a stream or other body of water.

Simple abutment: An abutment consisting of a single or multiple sill logs, as opposed to cribbing.

Skew angle: The angle between a culvert and the direction of the road into which the culvert is installed.

Slash: Brush, tree tops, and other woody debris left following a logging or thinning operation.

Span: The horizontal distance or "spread" between abutments of a bridge.

Stage: The vertical distance between the top of a pond's mechanical spillway and the bottom of its emergency spillway.

Stilling basin: A depression built at the outlet end of a culvert for the purpose of slowing water velocity in order to allow the passage of fish through the culvert.

Stream width:		See "channel width".
Stringer:		A length of timber laid between the abutments of a bridge which is used to support the decking and cross-pieces of the bridge.
Surface runoff:		See "runoff".
Tamping:		The compaction of fill around a structure, such as a culvert, to give it support.
Trash rack:		A metal rack attached to a pond outlet structure which prevents it from becoming plugged with floating debris.
Trickle tube:		A section of vertical pipe attached to a horizontal pipe which serves as an outlet structure for a pond. Trickle tubes are usually screened and are used to control the normal water level of a pond.
Thread of a watercourse:		The line connecting the lowest points along the bed of a watercourse.
Toe of fill:		The farthest lateral projection of fill placed around a structure.
Topographical map:		A map which uses contour lines to show the physical features of land.
Travel planking:		Planking laid across the cross decking of a bridge which serves as a vehicle travel surface.
Upland:		The elevated land above the low areas along a watercourse.
Used for navigation:		Those watercourses used by motorized watercraft.
Waste:		As defined in the Clean Water Act, includes rubbish, slimes, tailings, effluent, sewage, fumes, smoke, other waste products, or any other matter that is prescribed to be waste.
Water control structures:		For the purposes of the Provisional Permit System standards, includes spillways, aboideaux, sluiceway and other structures which control flow by mechanical means.
Watercourse:	(1)	A natural or man-made channel through which water flows.
	(2)	The water contained in such a channel.

(3) Under the Watercourse Alteration Regulation, a watercourse is defined as: the full width and length, including the beds, banks, sides, and shoreline of any river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, or any part thereof, the primary function of which is the conveyance or containment of water, whether the flow be continuous or not.

Watercourse alteration: Any change made intentionally at, near, or to a watercourse, both temporary and permanent.

Watercourse Alteration Permit: A permit issued under the Watercourse Alteration Regulation entitling the permittee to undertake a watercourse alteration. Watercourse Alteration Permits are subject to various conditions of approval.

Watershed: A region or area bounded peripherally by water draining, or flowing into, a particular watercourse.

Waterway opening: The area under a bridge through which water is free to flow. Waterway opening is calculated by multiplying the clear span between the abutments by the average distance from the bed of the watercourse to the underside of the stringers spanning the abutments.

Wingwalls: Vertical sidewalls of a structure, such as a bridge abutment, which are built at an angle to the road for the purpose of retaining fill.